JEE MAIN MODEL GRAND TEST (2017)

IMPORTANT INSTRUCTIONS

1. Immediately fill in the particulars on this page of the Test Booklet with Blue/Black Ball Point Pen. Use of pencil is strictly prohibited.
2. The test is of 3 hours duration.
3. The Test Booklet consists of 90 questions. The maximum marks are 360.
4. There are three parts in the question paper A, B, C consisting of Physics, Chemistry and Mathematics having 30 questions in each part of equal weightage. Each question is allotted 4 (four) marks for correct response.
5. Candidates will be awarded marks as stated above in instruction No. 4 for correct response of each question. (1/4) (one fourth) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.
6. There is only one correct response for each question. Filling up more than one response in any question will be treated as wrong response and marks for wrong response will be deducted accordingly as per instruction 5 above.

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PHYSICS

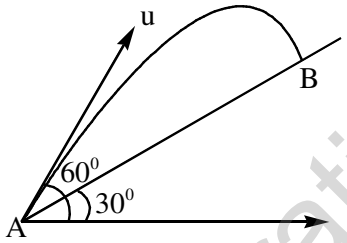
1. In the equation $\int \frac{dt}{\sqrt{2at-t^2}} = a^x \sin^{-1}\left[\frac{t}{a}-1\right]$. The value of x is

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

2. Two cars start off to race with velocities 4 m / s and 2 m /s and trvel in straight line with uniform accelerations 1 m/s^2 and 2 m/s^2 respectively. If they reach the final point at the same instant, then the length of the path is

   1) 30 m 2) 32 m 3) 20 m 4) 24 m

3. Time taken by the projectile to reach from A to B is t. Then the distance AB is equal to



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

4. A block of mass m slides down an inclined plane of inclination θ with uniform speed. The coefficient of friction between the block and the plane is μ.The contact force between the block and the plane is

   1) mg 2) $mg\sin\theta\sqrt{1+\mu^2}$ 3) $mg\sin\theta$ 4) $\sqrt{(mg\sin\theta)^2+(\mu mg\cos\theta)^2}$

5. A 15g ball is shot from a spring gun whose spring has a force constant of 600 N/m. The spring is compressed by 5cm. The greatest possible horizontal range of the ball for this compression is (g = 10 m/s^2)

   1) 6.0 m 2) 12.0 m 3) 10.0m 4) 8.0 m

6. Displacement of a particle of mass 2 kg moving in a straight line varies with time as $s=\left(2t^3+2\right)m$. Impulse of the force acting on the particle over a time interval between t = 0 and t = 1s is

   1) 10 N-s 2) 12 N-s 3) 8 N-s 4) 6 N-s

7. A particle of mass 1 kg is moving along the line $y = x + 2$ (here , x and y are in metres) with speed 2 m/s. The magnitude of angular momentum of particle about origin is

1) 4 kg – m^2 / s 2) $2\sqrt{2}kg$ -m^2 /s 3) $4\sqrt{2}kg - m^2 / s$ 4) $2kg - m^2 / s$

8. A hole is drilled from the surface of earth to its centre. A particle is dropped from rest at the surface of earth. The speed of the particle when it reaches the centre of the earth in terms of its escape velocity on the surface of earth v_e is

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

9. Maximum speed of a particle in simple harmonic motion is v_{max}. Then average speed of a particle in SHM is equal to

1) $\frac{v_{max}}{2}$ 2) $\frac{v_{max}}{\pi}$ 3) $\frac{\pi v_{max}}{2}$ 4) $\frac{2v_{max}}{\pi}$

10. A water proofing agent changes the angle of contact from

1) acute to 90^0 2) obtuse to 90^0

3) an acute to obtuse angle 4) an obtuse to an acute angle

11. The viscous force acting on a solid ball of surface area A moving with terminal velocity v is proportional to

1) A 2) $A^{1/2}$ 3) v^2 4) $v^{1/2}$

12. The equation of a wave disturbance is given as $y = 0.02\cos\left(\frac{\pi}{2} + 50\pi t\right)\cos(10\pi x)$, where x and y are in metres and t in seconds. Choose the wrong statement

1) Antinode occurs at x = 0.3 m 2) The wavelength is 0.2m

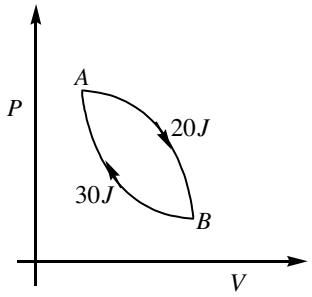
3) The speed of the constituent waves is 5 m/s

4) Node occurs at x = 0.15m

13. An open organ pipe of length *l* is sounded together with another open organ pipe of length *l*+x in their fundamental tones. Speed of sound in air is v. The beat frequency heard will be (x<<*l*).

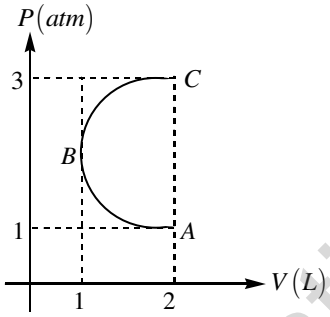
1) $\frac{vx}{4l^2}$ 2) $\frac{vl^2}{2x}$ 3) $\frac{vx}{2l^2}$ 4) $\frac{vx^2}{2l}$

14. In a cyclic process shown in the figure an ideal gas is adiabatically taken from B to A, the work done on the gas during the process $B \to A$ is 30 J, when the gas is taken from $A \to B$ the heat absorbed by the gas is 20 J. The change in internal energy of the gas in the process $A \to B$ is



1) 20 J 2) -30 J 3) 50 J 4) -10 J

15. In the P-V diagram shown in figure ABC is a semi circle . The work done in the process ABC is



1) Zero 2) $\frac{\pi}{2} atm - L$ 3) $-\frac{\pi}{2} atm - L$ 4) 4 atm –L

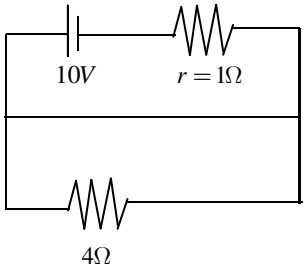
16. a convex lens forms a real image three times larger than the object on a screen. Object and screen are moved until the image becomes twice the size of the object. If the shift of the object is 6 cm. The shift of screen is

1) 36 cm 2) 72 cm 3) 18 cm 4) 9 cm

17. In young's double slit experiment the y- coordinates of central maxima and 10 th maxima are 2 cm and 5 cm respectively. When the YDSE apparatus is immersed in a liquid of refractive index 1.5 the corresponding y coordinates will be

1) 2 cm, 7.5 cm 2) 3 cm, 6 cm 3) 2 cm, 4 cm 4) 4/3 cm, 10/3 cm

18. Potential difference across the terminals of the battery shown in figure is



1) 8V 2)10V 3) 6V 4) Zero

19. A steady current flows in a metallic conductor of non – uniform cross – section. The quantity/ quantities constant along the length of the conductor is / are

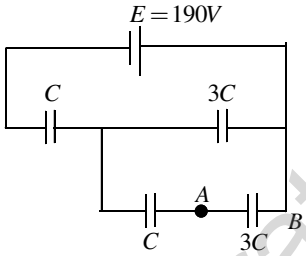
1) current, electric field and drift speed 2) drift speed only

3) current and drift speed 4) current only

20. A point charge q is placed inside a conducting spherical shell of inner radius 2R and outer radius 3R at a distance of R from the centre of the shell. The electric potential at the centre of shell will be $\frac{1}{4\pi \in_0}$ times

1) $\frac{q}{2R}$ 2) $\frac{4q}{3R}$ 3) $\frac{5q}{6R}$ 4) $\frac{2q}{3R}$

21. In the circuit shown in figure potential difference between A and B is



1) 30V 2) 60V 3) 10V 4) 90V

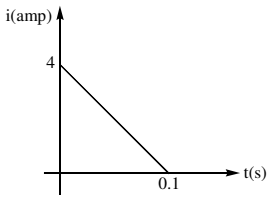
22. Magnetic field at the centre of a circular loop of area A is B. Then magnetic moment of the loop will be

1) $\frac{BA^2}{\mu_0 \pi}$ 2) $\frac{BA}{\mu_0}\sqrt{A}$ 3) $\frac{BA\sqrt{A}}{\mu_0 \pi}$ 4) $\frac{2BA}{\mu_0}\sqrt{\frac{A}{\pi}}$

23. A conducting rod of mass m and length l is placed over a smooth horizontal surface. A uniform magnetic field B is acting perpendicular to the rod. Charge q is suddenly passed through the rod and it acquires an initial velocity v on the surface, then q is equal to

1) $\frac{2mv}{Bl}$ 2) $\frac{Bl}{2mv}$ 3) $\frac{mv}{Bl}$ 4) $\frac{Blv}{2m}$

24. Some magnetic flux is changed from a coil of resistance 10Ω. As a result an induced current is developed in it, which varies with time as shown in figure. The magnitude of change in flux through the coil in webers is



1) 2 2) 4 3) 6 4) 8

25. At a frequency ω_0 the reactance of a certain capacitor equals that of a certain inductor. If the frequency is changed to $2\omega_0$, what is the ratio of the reactance of the inductor to that of the capacitor?

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

26. de-Broglie wavelength of an electron in the nth Bohr orbit is λ_n and the angular momentum is J_n, then

1) $J_n \alpha \lambda_n$ 2) $\lambda_n \alpha \frac{l}{J_n}$ 3) $\lambda_n \alpha J_n^2$ 4) none of these

27. When a hydrogen atom emits a photon during the transition n = 5 to n = 1, its recoil speed is approximately

1) 4 m/s 2) 800 m/s 3) 3 mm/s 4) 0.1 mm/s

28. A hydrogen atom is in an excited state of principle quantum number n. It emits a photon of wavelength λ when returns to the ground state. The value of n is

1) $\sqrt{\lambda R(\lambda R-1)}$ 2) $\sqrt{\frac{(\lambda R-1)}{\lambda R}}$ 3) $\sqrt{\frac{\lambda R}{\lambda R-1}}$ 4) $\sqrt{\lambda(R-1)}$

29. The dominant mechanism for motion of charge carriers in forward and reverse biased silicon p-n junctions are

1) drift in forward bias, diffusion in reverse bias

2) diffusion in forward bias, drift in reverse bias

3) diffusion in both forward and reverse bias

4) drift in both forward and reverse bias

30. A transistor is used in common emitter mode as an amplifier, then

1) the base emitter junction is reverse biased

2) the input signal is connected in series with the voltage applied to bias the base emitter junction

3) the input signal is connected in series with the voltage applied to bias the base collector junction

4) transistor is not used in common emitter mode as an amplifier

CHEMISTRY

31. A 100W bulb gives a monochromatic radiation of wave length 400 nm. Calculate the number of photons emitted by the bulb in one second

1) 4.0×10^{4} 2) 2.012×10^{20} 3) 6.02×10^{23} 4) 1.89×10^{34}

32. The ratio of rate of diffusion of SO_2, O_2 and CH_4 is

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

33. Dissolving 120g of urea (molecular weight 60) in 1000g of water gives a solution of density 1.15 gmL^{-1}. The molarity of solution is

1) 1.78M 2) 2.05M 3) 2.5M 4)2.75M

34. Shape and hybridization of IF_5 molecule respectively are

1) Trigonal bipyramidal, sp^3d 2) See saw, sp^3d

3) Square pyramidal, sp^3d^2 4) Pentagonal pyramidal, sp^3d^3

35. The correct statement about O_2 and O_2^+ according to molecular orbital theory is

1) O_2^+ is paramagnetic and bond order is lesser than that for O_2

2) O_2^+ is paramagnetic and bond order is more than that for O_2

3) O_2^+ is diamagnetic and bond order is lesser than that for O_2

4) O_2^+ is diamagnetic and bond order is more than that for O_2

36. The entropy change involved in isothermal reversible expansion of 5 mol of an ideal gas from a volume of 10L to 100L at 300K is

1) $+95.7JK^{-1}$ 2) $-28.72JK^{-1}$ 3) $+28.72JK^{-1}$ 4) $-95.7JK^{-1}$

37. 0.2g of a substance dissolved in 20g of a solvent boiled at a temperature higher by 0.52^0C than that of the pure solvent. The molecular mass of substance is
(K_b for solvent is 5.2K. molal $^{-1}$)

1) 1.01 2) 10.1 3) 100 4) 10

38. In the reaction, $PCl_{5(g)} \rightleftharpoons PCl_{3(g)} + Cl_{2(g)}$, the amounts of PCl_5, PCl_3 and Cl_2 are 2 mole each at equilibrium & the total pressure is 3 atmosphere. The equilibrium constant , k_p is

1)1 atm 2) 2 atm 3) 3 atm 4) 1.5 atm

39. For which of the following sparingly soluble salts, the solubility (s) and the solubility product $\left(K_{sp}\right)$ are related by the expression $S=\left(K_{sp}/4\right)^{1/3}$?

1) $BaSO_4$ 2) $Ca_3\left(PO_4\right)_2$ 3) Ag_3PO_4 4) Hg_2Cl_2

40. In the balanced chemical reaction $IO_3^- + aI^- + bH^+ \longrightarrow cH_2O + dI_2$ a,b,c and d respectively correspond to

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

41. The limiting molar conductivities, Λ^0 of NaCl, KBr and KCl are 126, 152 and 150 S cm^2 mol^{-1} respectively. The Λ^0 for NaBr is

1) 278 S.cm^2 mol^{-1} 2) 976 Scm^2mol^{-1} 3)128 Scm^2mol^{-1} 4) 302 Scm^2 mol^{-1}

42. In a first order reaction, the concentration of reactant decreases from $800 mol/dm^3$ to $50 mol/dm^3$ in 2×10^4 s . The rate constant of the reaction in S^{-1} is

1) 2×10^4 2) 3.45×10^{-5} 3) 1.386×10^{-4} 4) 2×10^{-4}

43. The correct thermodynamic conditions of adsorption of gases on solids are

1) $\Delta H = -ve, \Delta S = +ve, \Delta G = -ve$ 2) $\Delta H = -ve, \Delta S = -ve, \Delta G = +ve$

3) $\Delta H = +ve, \Delta S = +ve, \Delta G = -ve$ 4) $\Delta H = -ve, \Delta S = -ve, \Delta G = -ve$

44. The smallest in size among the following is

1) Na^+ 2) F^- 3) O^{-2} 4) N^{-3}

45. Name the metal, M which is extracted based on the following equation

$4M + 8CN^- + 2H_2O + O_2 \longrightarrow 4\left[M(CN)_2\right]^- + 4OH^-$

$2\left[M(CN)_2\right]^- + Zn \longrightarrow \left[Zn(CN)_4\right]^{-2} + 2M$

1) Cu 2) Au 3) Ni 4) Al

46. Which of the following sequences is correct with respect to the property mentioned in the brackets?

1) $LiH > NaH > KH > RbH$ (Ionic nature)
2) $Cs^+ > Rb^+ > K^+ > Na^+$ (Ionic mobility in aqueous solution)
3) $BeCO_3 > MgCO_3 > CaCO_3 > BaCO_3$ (Thermal stability)
4) $CaSO_4 < BaSO_4 < MgSO_4$ (Solubility in water)

47. Orthoboric acid H_3BO_3 behaves as weak monobasic acid giving H_3^+O and _____ in water

1) $H_2BO_2^+$ 2) $H_2BO_2^-$ 3) $\left[B(OH)_4\right]^-$ 4) $\left[B(OH)_4\right]^+$

48. The incorrect statement among the following is

1) ClO^- ion can undergo disproportionation2) N_2O and NO are neutral oxides of nitrogen

3) The oxidation state of sulphur in $H_2S_2O_8$ is +8

4) XeF_4 has square planar shape with sp^3d^2 hybridisation

49. $KMnO_4$ acts as an oxidant in acidic, basic & neutral media. The corresponding reduced species of $KMnO_4$ are respectively

1) $MnO_4^{-2}, Mn^{+2}, MnO_2$ 2) $Mn^{+2}, MnO_2, MnO_4^{-2}$

3) $Mn^{+2}, MnO_4^{-2}, MnO_2$ 4) $MnO_2, Mn^{+2}, MnO_4^{-2}$

50. Which of the following is paramagnetic

1) $K_4\left[Fe(CN)_6\right]$ 2) $\left[Ni(CO)_4\right]$ 3) $K_3\left[Fe(CN)_6\right]$ 4) $\left[Co(NH_3)_6\right]Cl_3$

51. Addition of sodium nitroprusside to Lassaigne's solution gives violet colour. The colour is due to the formation of

1) $Na_4\left[Fe(CN)_6\right]$ 2) $Na_4\left[Fe(CN)_5 NOS\right]$

3) $Fe_4\left[Fe(CN)_6\right]$ 4) $Na_3\left[Fe(CN)_5 NOS\right]$

52. The more stable carbocation among the following is

1) $\overset{+}{C}H_3$ 2) $CH_2=\overset{+}{C}H$ 3) $C_6H_5\overset{+}{C}H_2$ 4) $CH_3-\overset{+}{C}H_2$

53. $CaC_2 \xrightarrow{H_2O} A \xrightarrow[600^0C]{Fe} B \xrightarrow[AlCl_3]{CH_3Cl} C$. The final product 'C' is

1) 2-Butene 2) 2- Butyne 3) Toluene 4) Benzene

54. When a mixture of CH_3I and CH_3CH_2I is subjected to wurtz reaction, the product not formed is

1) Ethane 2) Propane 3) Butane 4) Pentane

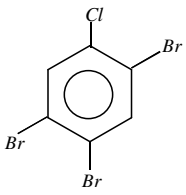
55. The most acidic compound among the following is

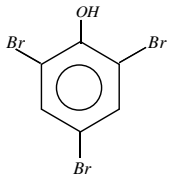
1) Phenol 2) p-cresol 3) p-Nitrophenol 4) Picric acid

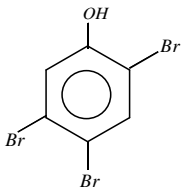
56. The order of reactivity of carbonyl compounds towards nucleophilic addition reaction is

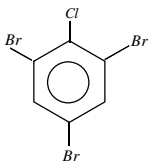
1) $CH_3COCH_3 > CH_3CHO > HCHO > C_6H_5CHO$
2) $C_6H_5CHO > CH_3COCH_3 > CH_3CHO > HCHO$
3) $HCHO > CH_3CHO > CH_3COCH_3 > C_6H_5CHO$
4) $CH_3CHO > HCHO > CH_3COCH_3 > C_6H_5CHO$

57. Aniline is treated with bromine water to give an organic compound (X) which when treated with $NaNO_2$ and HCl at 0^0C gives a water soluble compound (Y) . Compound (Y) on treatment with Cu_2Cl_2 and HCl gives compound (Z). Compound (Z) is

1) 

2) 

3) 

4) 

58. The Biodegradable polymer used in orthopaedic devices and in controlled drug release is

1) Orlon 2) PTFE 3) PHBV 4) SBR

59. The disease Rickets is caused by deficiency of vitamin

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

60. Salvarsan is arsenic containing drug which was first used for the treatment of

1) Syphilis 2) Typhoid 3) Meningitis 4) Dysentery

MATHEMATICS

61. Number of real roots of $(6-x)^4+(8-x)^4=16$ is

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

62. Let $\bar{a},\bar{b}$ and $\bar{c}$ be three unit vectors such that $\bar{a}\times(\bar{b}\times\bar{c})=\frac{\sqrt{3}}{2}(\bar{b}+\bar{c})$. If $\bar{b}$ is not parallel to $\bar{c}$, then the angle between $\bar{a}$ and $\bar{b}$ is

1) $\frac{5\pi}{6}$ 2) $\frac{3\pi}{4}$ 3) $\frac{\pi}{2}$ 4) $\frac{2\pi}{3}$

63. If argz = θ, $0<\theta<\frac{\pi}{2}$ and $|z-3i|=3$, then $\cot\theta-\frac{6}{z}=$

1) 1 2) -1 3) i 4) –i

64. The value of $\left\{\frac{3^{2003}}{28}\right\}$ where $\{.\}$ denotes the fractional part

1) $\frac{17}{28}$ 2) $\frac{23}{28}$ 3) $\frac{19}{28}$ 4) 0

65. If the standard deviation of the numbers 2, 3, a and 11 is 3.5, then which of the following is true?

1) $3a^2-23a+44=0$ 2) $3a^2-26a+55=0$ 3) $3a^2-32a+84=0$ 4) $3a^2-34a+91=0$

66. Let $p=\lim_{x\to 0+}\left(1+\tan^2\sqrt{x}\right)^{\frac{1}{2x}}$, then log p is equal to

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

67. If the line $\frac{x-3}{2}=\frac{y+2}{-1}=\frac{z+4}{3}$ lies on the plane lx +my-z=9, then $l^2+m^2=$

1) 26 2) 18 3) 5 4) 2

68. If p,q,r are simple propositions, with truth values T,F and T, then the truth value of $(\sim p\vee q)\wedge(\sim r)\Rightarrow p$ is

1) true 2) false 3) true if r is false 4) true if q is true

69. The number of ways of choosing 10 balls from infinite white, red, blue and green balls is

1) 84 2) 90 3) 100 4) 286

70. The equation of the curve passing through the point $\left(1,\frac{\pi}{4}\right)$ and having slope of tangent at any point (x,y) as $\frac{y}{x}-\cos^2\left(\frac{y}{x}\right)$ is

1) $x=e^{1+\tan\left(\frac{y}{x}\right)}$ 2) $x=e^{1-\tan\left(\frac{y}{x}\right)}$ 3) $x=e^{1+\tan\left(\frac{x}{y}\right)}$ 4) $x=e^{1-\tan\left(\frac{x}{y}\right)}$

71. If $f(x)=\begin{cases}e^{\cos x}\sin x & |x|\le 2\\ 2 & ,\ otherwise\end{cases}$ then $\int_{-2}^{3} f(x)dx$ is equal to

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

72. A basket contains 5 apples and 7 oranges and another basket contains 4 apples and 8 oranges one fruit is picked out from each basket. Find the probability that the fruits are both apples or both oranges

1) $\frac{24}{144}$ 2) $\frac{56}{144}$ 3) $\frac{68}{144}$ 4) $\frac{76}{144}$

73. The value of $\tan\left\{\cos^{-1}\left(-\frac{2}{7}\right)-\frac{\pi}{2}\right\}$ is

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

74. ABCD is a trapezium such that AB and CD are parallel and $BC\perp CD$. If $\angle ADB=\theta$, $BC=p$ and CD=q, then AB is equal to

1) $\frac{\left(p^2+q^2\right)\sin\theta}{p\cos\theta+q\sin\theta}$ 2) $\frac{\left(p^2+q^2\right)\cos\theta}{p\cos\theta+q\sin\theta}$ 3) $\frac{\left(p^2+q^2\right)}{p^2\cos\theta+q^2\sin^2\theta}$ 4) $\frac{\left(p^2+q^2\right)\sin\theta}{\left(p\cos\theta+q\sin\theta\right)^2}$

75. In a statistical investigation of 1003 families of Kolkata, it was found that 63 families had neither a radio nor a TV, 794 families had a radio and 187 had a TV. The number of families in that group had both a radio and a TV is

1) 36 2) 32 3) 41 4) 42

76. $\int\frac{2x^{12}+5x^9}{\left(x^5+x^3+1\right)^3}dx=$

1) $\frac{-x^5}{\left(x^5+x^3+1\right)}+c$ 2) $\frac{x^{10}}{2\left(x^5+x^3+1\right)^2}+c$ 3) $\frac{x^5}{2\left(x^5+x^3+1\right)^2}+c$ 4) $\frac{-x^{10}}{2\left(x^5+x^3+1\right)^2}+c$

77. If the function $g(x)=\begin{cases}k\sqrt{x+1} & 0\le x\le 3\\ mx+2 & 3<x\le 5\end{cases}$ is differentiable, then the value of k+m is

1) 2 2) $\frac{16}{5}$ 3) $\frac{10}{3}$ 4) 4

78. If A is a square matrix such that $A(AdjA)=\begin{bmatrix}4&0&0\\0&4&0\\0&0&4\end{bmatrix}$, then $\frac{|adj(adjA)|}{|adjA|}$ is equal to

1) 256 2) 64 3) 32 4) 16

79. If $u_n=\begin{vmatrix}1&k&k\\2n&k^2+k+1&k^2+k\\2n-1&k^2&k^2+k+1\end{vmatrix}$ and $\sum_{n=1}^{k}u_n=72$ then k =

1) 8 2) 9 3) 6 4) 10

80. Consider an infinite geometric series with first term 'a' and common ratio 'r'. If its sum is 4 and second term is 3/4 then

1) $a=\frac{4}{7},r=\frac{3}{7}$ 2) $a=2,r=\frac{3}{8}$ 3) $a=\frac{3}{2},r=\frac{1}{2}$ 4) $a=3,r=\frac{1}{4}$

81. The domain of the function $f(x)=\frac{\log_2(x+3)}{x^2+3x+2}$ is

1) $R-\{-1,2\}$ 2) $(-2,\infty)$ 3) $R-\{-1,2,-3\}$ 4) $(-3,\infty)-\{-1,-2\}$

82. $\cos^{40}\theta+\sin^{58}\theta=1\Rightarrow\theta=$

1) $(2n+1)\frac{\pi}{2},n\in z$ 2) $n\pi,n\in z$

3) $\left\{(2n+1)\frac{\pi}{2}\right\}\cup\{n\pi\},n\in z$ 4) $\left\{(2n+1)\frac{\pi}{2}\right\}\cup\left\{(3n+1)\frac{\pi}{2}\right\}n\in z$

83. $\underset{n\to\infty}{Lim}\left[\frac{(n+1)(n+2).....3n}{n^{2n}}\right]^{1/n}$ is equal to

1) $\frac{18}{e^4}$ 2) $\frac{27}{e^2}$ 3) $\frac{9}{e^2}$ 4) $3\log 3-2$

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

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

85. The sum of the first n terms of the series $\frac{1}{2}+\frac{3}{4}+\frac{7}{8}+\frac{15}{16}+.....$ is equal to

1) 2^n-n+1 2) $1-2^{-n}$ 3) $n+2^{-n}-1$ 4) 2^n-1

86. The area of the region described by $A=\{(x,y):x^2+y^2\le 1\ and\ y^2\le 1-x\}$ is

1) $\frac{\pi}{2}+\frac{4}{3}$ 2) $\frac{\pi}{2}-\frac{4}{3}$ 3) $\frac{\pi}{2}-\frac{2}{3}$ 4) $\frac{\pi}{2}+\frac{2}{3}$

87. The angle between the lines whose direction cosines satisfy the equations $l+m+n=0$ and $l^2=m^2+n^2$ is

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

88. Let C be the circle with centre at (1,1) and radius 1. If T is the circle centered at (0,k) passing through the origin and touching the circle C externally, then the radius of T is equal to

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

89. The shortest distance between the line $y=x+1$ and the curve $x=y^2$ is

1) $\frac{3\sqrt{2}}{8}$ 2) $\frac{8}{3\sqrt{2}}$ 3) $\frac{4}{\sqrt{3}}$ 4) $\frac{\sqrt{3}}{4}$

90. The equation of the circle passing through the foci of the ellipse $\frac{x^2}{16}+\frac{y^2}{9}=1$ and having centre at (0,3) is

1) $x^2+y^2-6y-7=0$ 2) $x^2+y^2-6y+7=0$

3) $x^2+y^2-6y-5=0$ 4) $x^2+y^2-6y+5=0$

JEE MAIN GRAND TEST

KEY SHEET

PHYSICS

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

CHEMISTRY

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

MATHS

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

JEE MAIN GRAND TEST

HINTS & SOLUTIONS

Physics

1. The quantity $\left(\frac{t}{a}-1\right)$ is dimension less

$\therefore [a]=[t]$

$\left[\sqrt{2at-t^2}\right]=[t]$ or $\left[\frac{dt}{\sqrt{2at+t^2}}\right]=\left[\frac{t}{t}\right]=M^0L^0T^0$

a^X should also be dimensionless

$\therefore X=0$

2. $S=4t+\frac{1}{2}(1)t^2=2t+\frac{1}{2}(2)t^2$

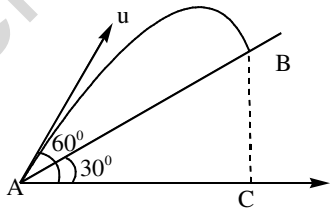
$4t+0.5t^2=2t+t^2$

$\frac{t^2}{2}=2t\Rightarrow t=0$ & $t=4S$

$\therefore S=4(4)+\frac{1}{2}(1)4^2$

$S=16+8=24m$

3.



Horizontal component of velocity

$u_H=u\cos 60^0=\frac{u}{2}$

$\therefore AC=u_{H^+}=\frac{ut}{2}$

and $AB=AC\sec 30^0=\frac{ut}{2}\left(\frac{2}{\sqrt{3}}\right)$

$\therefore AB=\frac{ut}{\sqrt{3}}$

4. Block slides down with constant velocity hence, net force on the block is zero. Only two forces are acting on the block, one is weight (mg) acting vertically down wards and the other is contact force between the block and the plane. For net force to be zero, the contact force (friction + normal reaction) should be equal to its weight (mg) is vertically upward direction.

5. $R_{\max} = \frac{u^2}{g}\ at\ \theta = 45^0$

$= \left(\frac{mu^2}{2}\right)\left(\frac{2}{mg}\right)$

$= \left(\frac{1}{2}KX^2\right)\left(\frac{2}{mg}\right)\ \left(\because \frac{1}{2}mu^2 = \frac{1}{2}KX^2\right)$

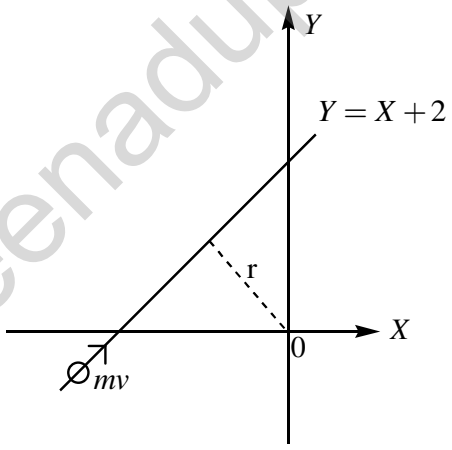
$R_{\max} = \frac{KX^2}{mg} = \frac{(600)\left(5\times10^{-2}\right)^2}{\left(15\times10^{-3}\right)(10)} = 10m$

6. $V = \frac{ds}{dt} = 6t^2$

Impuse $= \Delta P = m\left(V_t - V_i\right)$

$= 2\left(6\times1-0\right) = 12NS$

7.



Angular moment of particle about origin '0' is

$L = mvr_{\perp} = 1\times2\times2\cos45^0$

$\therefore L = \frac{4}{\sqrt{2}} = 2\sqrt{2}Kg\frac{m^2}{S}$

8. Kinetic energy at centre =

Potential Energy at surface – potential energy at centre

$\frac{1}{2}mV^2 = -\frac{GMm}{R} - \left(-\frac{3}{2}\frac{GMm}{R}\right)$

$$\frac{1}{2}mV^2 = \frac{1}{2}\frac{GMm}{R}$$

$$V = \sqrt{\frac{GM}{R}} = \sqrt{gR} = \frac{V_e}{\sqrt{2}}$$

9. $V_{\max} = aw$

$$V_{ave} = \frac{\textbf{distance travelled in one oscillation}}{\textbf{time period}}$$

$$= \frac{4a}{T} = \frac{4aw}{2\pi}$$

$$V_{ave} = \frac{2aw}{\pi} = \frac{2V_{\max}}{\pi}$$

10. Conceptual question

11. $F = 6\pi\eta rv$

$\therefore F \alpha V$ and $F \alpha r$ or $F \alpha A^{1/2}$

12. $w = 50\pi$ and $k = 10\pi$

$\therefore$ speed = $\frac{50\pi}{10\pi} = 5m/s$

13. Beat frequency = $f_1 - f_2$

$$= \frac{\mathbf{v}}{2l} - \frac{\mathbf{v}}{2(l+x)}$$

$$= \frac{\mathbf{v}}{2l}\left[1 - \left(1 + \frac{x}{l}\right)^{-1}\right]$$

$$= \frac{\mathbf{v}}{2l}\left[1 - 1 + \frac{x}{l}\right]$$

$$f_1 - t_2 = \frac{\mathbf{v}x}{2l^2}$$

14. $w_{BA} = -30J, Q_{BA} = 0$

$\therefore U_{BA} = -w_{BA} = 30J$

$\Delta U_{BA} = -U_{BA} = -30J$

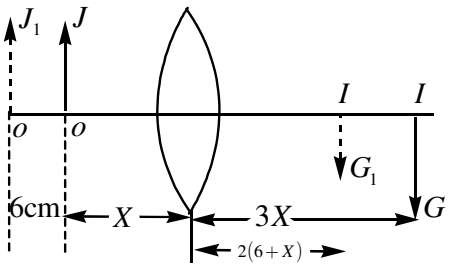
15. W_{AB} is negative (volume is decreasing)

and W_{BC} is positive (volume is increasing)

and $|W_{BC}| > |W_{AB}|$

$\therefore$ Net work done is positive and area between semi circle which is equal to $\frac{\pi}{2}$ atm – L

16.



$$\frac{1}{3X}+\frac{1}{X}=\frac{1}{f}$$

$$\frac{4}{3X}=\frac{1}{f}------(1)$$

$$\frac{1}{2(6+X)}+\frac{1}{(6+X)}=\frac{1}{f}$$

$$\frac{3}{2(6+X)}=\frac{1}{f}----(2)$$

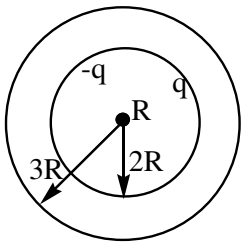
From (1) and (2) gives

$$\frac{4}{3X}=\frac{3}{2(6+X)}\Rightarrow X=48cm$$

Shift of screen $=3X-2(6+X)$

$=3\times48-2(6+48)=36cm$

17. Fringe width $w\alpha\lambda$. There λ and 'w' will decrease 1.5 times when immersed in liquid. The distance between central maxima and 10^{th} maxima is 3cm in vacuum. When immersed in liquid it will reduce to 2 cm. Position of central maxima will not change while 10^{th} maxima will be obtained at Y = 4 cm
18. Battery is short circuited. Therefore potential difference across its terminals will be zero.
19. Conceptual question
20.



Induced charges will be – q and +q

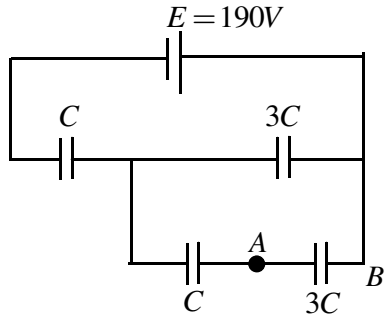
as shown in figure.

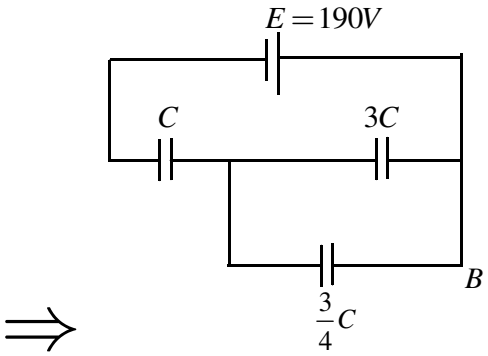
Potential at centre 'O' will be

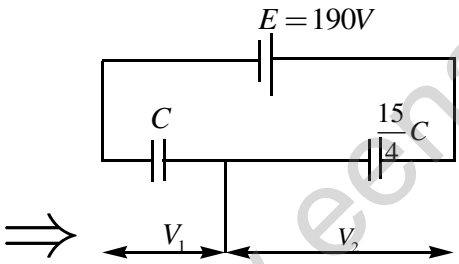
$$V_0 = \frac{1}{4\pi \in_0}\left[\frac{q}{R} - \frac{q}{2R} + \frac{q}{3R}\right]$$

$$V_0 = \frac{1}{4\pi \in_0}\left[\frac{5q}{6R}\right]$$

21.







$$\frac{V_1}{V_2} = \frac{(15/4)C}{C} = \frac{15}{4}$$

$$\therefore V_2 = \frac{4}{19} \times 190 = 40V$$

Now this 40V is distributed in C and 3C in the ratio of 3:1

$$\therefore V_{AB} = 10V$$

22. Let R be the radius of the loop. Then

$$A = \pi R^2 \text{ or } R = \sqrt{\frac{A}{\pi}}$$

$$B=\frac{\mu_0 i}{2R} \text{ or } i=\frac{2BR}{\mu_0}$$

$$M=iA=\frac{2BR}{\mu_0}A \Rightarrow M=\frac{2B}{\mu_0}\sqrt{\frac{A}{\pi}}A$$

23. Impulse = change in linear momentum

$$\int Fdt=mv \text{ (or) } \int (Bil)dt=mv$$

$$Blq=mv\left(\because \int i\,dt=q\right)$$

$$\therefore q=\frac{mv}{Bl}$$

24. $|dq|=\frac{d\phi}{R}=i\,dt=$ Area under i-t graph

$\therefore d\phi=$ (Area under i-t graph) R

$$\therefore d\phi=\frac{1}{2}\times 4\times 0.1\times 10=2wb$$

25. $w_0=\frac{1}{\sqrt{LC}}$

$$\frac{X_L}{X_C}=\frac{WL}{\frac{1}{WC}}=W^2LC$$

Here , W=2w$_0$ = $2\times\frac{1}{\sqrt{LC}}$

$$\therefore \frac{X_L}{X_C}=\frac{4}{1}$$

26. $\lambda_n=\frac{2\pi r}{n}\Rightarrow \lambda_n \alpha n\left(\because r\alpha n^2\right)$

And $J_n\alpha n\left(\because J_n=\frac{nh}{2\pi}\right)$

$\therefore \lambda_n \alpha J_n$

27. Energy of photon = $13.6\left(1-\frac{1}{25}\right)eV=13.0eV$

Momentum is conserved

$$\therefore \frac{E}{c}=mv\Rightarrow V=\frac{E}{mc}$$

$$V = \frac{13 \times 1.6 \times 10^{-19}}{1.67 \times 10^{-27} \times 3 \times 10^{8}} = 4 m/s$$

28. $\frac{hc}{\lambda} = Rhc\sqrt{1 - \frac{1}{n^2}}$

$$\therefore n = \sqrt{\frac{\lambda R}{\lambda R - 1}}$$

29. Drift current flows from P-side to n-side and diffusion current from n-side to p-side

30. Conceptual question

Chemistry

31. 100 W = 100J energy

$$E = \frac{nhc}{\lambda}$$

$$100 = \frac{n \times 6.625 \times 10^{-34} \times 3 \times 10^{8}}{400 \times 10^{-9}}$$

$$n = 2.012 \times 10^{20}$$

32. $r_{so_2} : r_{o_2} : r_{CH_4} = \frac{1}{\sqrt{64}} : \frac{1}{\sqrt{32}} : \frac{1}{\sqrt{16}}$

$$= 1 : \sqrt{2} : 2$$

33. Mass of solution = 1000 + 120 = 1120g

Volume

of solution = $\frac{\text{mass}}{\text{density}} = \frac{1120}{1.15} = 973.5\text{ml}$

$$M = \frac{w \times 1000}{GMW \times V}$$

$$= \frac{120 \times 1000}{60 \times 973.9} = 2.05M$$

34. Conceptual

35. Conceptual

36. $\Delta S = 2.303\ nr\ \log \frac{V_2}{V_1}$

$$= 2.303 \times 5 \times 8.314 \times \log \frac{100}{10}$$

$$= 2.303 \times 5 \times 8.314 \times 1$$

$$= 95.7 JK^{-1}$$

37. $\Delta T_b = \frac{K_b \times w \times 1000}{GMW \times W}$

$GMW = \frac{K_b \times w \times 1000}{\Delta T_b \times W} = \frac{5.2 \times 0.2 \times 1000}{0.52 \times 20}$

$= 100$

38. Since the number of moles are equal for all the three gases at equilibrium, their partial pressures also should be equal

$P_{PCl_5} + P_{PCl_3} + P_{Cl_2} = 3atm$

$P_{PCl_5} = P_{PCl_3} = P_{Cl_2} = 1$ atm

$K_p = \frac{P_{PCl_3}.P_{Cl_2}}{P_{PCl_5}} = \frac{1 \times 1}{1} = 1$

39. $\underset{S}{Hg_2Cl_2} \rightleftharpoons \underset{S}{Hg_2^{+2}} + \underset{2S}{2Cl^-}$

$K_{S_P} = \left[Hg_2^{+2}\right]\left[Cl^-\right]^2$

$= [S][2S]^2$

$4S^3 = K_{S_P}$

$\therefore S = \left[\frac{K_{S_P}}{4}\right]^{1/3}$

40. $IO_3^- + 5I^- + 6H^+ \longrightarrow 3I_2 + 3H_2O$

41. $\Lambda^0_{NaBr} = \Lambda^0_{NaCl} + \Lambda^0_{KBr} - \Lambda^0_{KCl}$

$= 126 + 152 - 150 = 128$

42. In a first order reaction

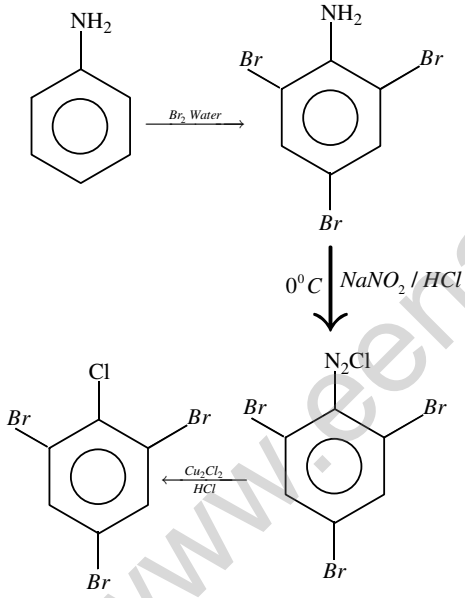
$2^n = \frac{a}{(a-x)}$ (n = no of half lives)

$2^n = \frac{800}{50} = 16 \quad \therefore n = 4$

$4t_{\frac{1}{2}} = 2 \times 10^4$ seconds

$\therefore t_{\frac{1}{2}} = 5 \times 10^3 s$

$K = \frac{0.693}{t_{\frac{1}{2}}} = \frac{0.693}{5 \times 10^3} = 1.386 \times 10^{-4}$

43. Conceptual
44. Among iso electronic species higher the atomic number, lesser is the size
45. Conceptual
46. Ionic mobility of hydrated ions of alkali metals increases down the group
47. $H_3BO_3 + H_2O \longrightarrow H_3^+O + B(OH)_4^-$
48. Higher oxidation state of sulphur is +6
49. Conceptual
50. In $K_3[Fe(CN)_6]$ there is one unpaired electron. Hence it is paramagnetic
51. Conceptual
52. Benzyl carbocation is resonance stabilized, hence more stable
53. $CaC_2 \xrightarrow{H_2O} CH \equiv CH \xrightarrow[600^0 C]{Fe}$
$C_6H_6 \xrightarrow[AlCl_3]{CH_3Cl} Toluene$
54. Conceptual
55. Conceptual
56. Conceptual
57. 

58. PHBV is a biodegradable polymer
59. Conceptual
60. Conceptual

Mathematics

61. 7-x =t

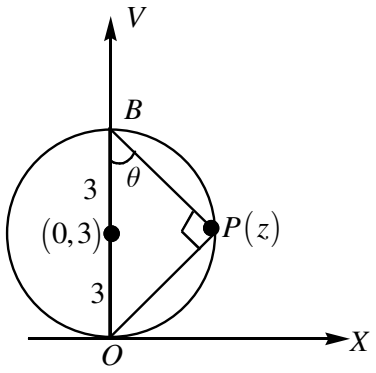
GE is $(t-1)^4 + (t+1)^4 = 16$

$\Rightarrow t^4 + 6t^2 + 1 = 8$

62. $(\overline{a}.\overline{c})\overline{b}-(\overline{a}.\overline{b})\overline{c}$

$=\frac{\sqrt{3}}{2}\overline{b}+\frac{\sqrt{3}}{2}\overline{c}$

63. $|z-3i|=3$ is the circle with centre $(0,3)$ radius 3



For ΔOPB $\sin\theta=\frac{OP}{6}$

$OP=6\sin\theta$

$z=OPcis\theta$

64. $\alpha^2=3^{2003}=3^2.3^{2001}$

$=9\left(3^3\right)^{667}=9(28-1)^{667}$

65. $\sigma^2=\frac{\sum x_i^2}{n}-\left(\frac{\sum x_i}{n}\right)^2$

66. $p=\underset{e^{x\to 0+}}{Lt}\frac{1}{2x}\left(\tan^2\sqrt{x}\right)$

67. Solving $3l-2m+4=9$ and $2l-m-3=0$

68. $(F\vee F)\wedge(F)\to T$

$F\wedge F\to T$

$F\to T$

True

69. $r=4,n=10$

${}^{(n+r-1)}C_{r-1}$

70. $\frac{dy}{dx}=\frac{y}{x}-\cos^2\frac{y}{x}$

Solution:

$$\int \frac{dv}{v-\cos^2 v-v} = \log cx$$

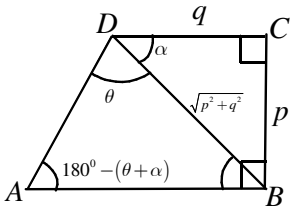
71. $\int_{-2}^{3} f(x)dx$

$$= \int_{-2}^{2} f(x)dx + \int_{2}^{3} f(x)dx$$

72. $\frac{5}{12}.\frac{4}{12}+\frac{7}{12}.\frac{8}{12}$

73. $\tan\left\{\pi-\cos^{-1}\left(\frac{2}{7}\right)-\frac{\pi}{2}\right\}$

74.



By sine rule from ΔABD

$$\frac{AB}{\sin\theta} = \frac{\sqrt{p^2+q^2}}{\sin\left(180^0-(\theta+\alpha)\right)}$$

75. $n\left(\overline{R}\cap\overline{T}\right)=63$

$n(R)=794 \;\; n(T)=187$

$n(RUT)=1003-63$

$=940$

$n(R\cup T)=n(R)+n(T)-n(R\cap T)$

76. $I=\int \frac{2x^{12}+5x^9}{x^{15}\left(1+x^{-2}+x^{-5}\right)^3}dx$

Put $1+\frac{1}{x^2}+\frac{1}{x^5}=t$

77. g is continuous

LHL = RHL

2K = 3m + 2 --------- (1)

LHD = RHD

$$\frac{K}{2\sqrt{x+1}} = m$$

$$\frac{k}{4} = m \ \ldots\ldots\ldots\ldots (2)$$

Solv (1) and (2)

78. $|A| = 4$

$$\left|Adj\left(AdjA\right)\right| = |A|^{(n-1)^2}$$

$$|AdjA| = |A|^{n-1}$$

79. $\sum_{n=1}^{k} u_n = 72$

$$\begin{vmatrix} k & k & k \\ k(k+1) & k^2+k+1 & k^2+k \\ k^2 & k^2 & k^2+k+1 \end{vmatrix} = 72$$

$c_2 \to c_2 - c_1$

$c_3 \to c_3 - c_1$

80. $\frac{a}{1-r} = 4 - - - - - (1)$

$ar = \frac{3}{4} - - - - (2)$

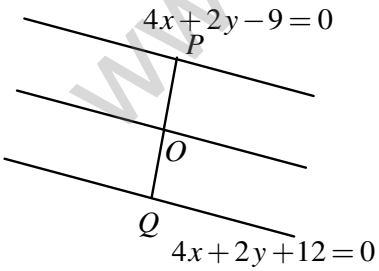
(1) /(2) $\Rightarrow$

81. $x+3>0, x^2+3x+2 \neq 0$

82. $\cos\theta = 0$ & $\sin\theta = 0$

83. $\log y = \underset{n\to\infty}{Lt} \frac{1}{n} \sum_{r=1}^{2n} \log\left(1+\frac{r}{n}\right)$

84.

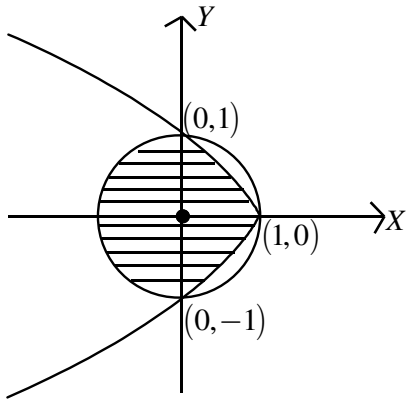


OP: OQ = $\frac{9}{\sqrt{20}} : \frac{12}{\sqrt{20}}$

85. $=\left(1-\frac{1}{2}\right)+\left(1-\frac{1}{4}\right)+\left(1-\frac{1}{8}\right)+.....+\left(1-\frac{1}{2^n}\right)$

$=n-\frac{1}{2}\frac{1.\left(1-\frac{1}{2^n}\right)}{1-\frac{1}{2}}$

86.



R. Area = $\frac{1}{2}\pi r^2+2\int_0^1\left(1-y^2\right)dy$

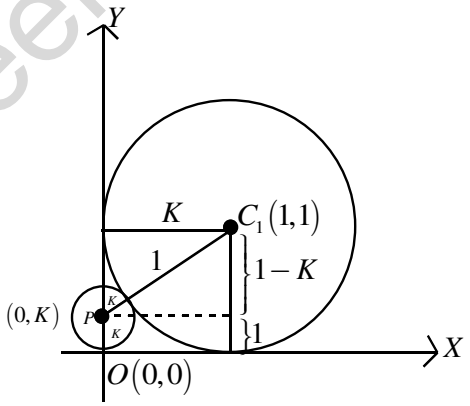
87. $l+m+n=0------(1)$

$l^2=m^2+n^2----(2)$

Solving (1) and (2)

We get d.cs of two lines

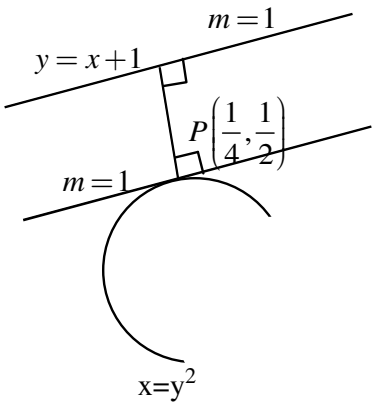
88.



$r_1+r_2=c_1c_2$

$k+1=\sqrt{1+(k-1)^2}$

89.



$\frac{dy}{dx} = \frac{1}{2y} = 1 \Rightarrow y = \frac{1}{2}$

$\Rightarrow x = \frac{1}{4}$

$SD = \frac{\left|\frac{1}{4} - \frac{1}{2} + 1\right|}{\sqrt{2}}$

90. $a = 4, b = 3$

$e = \sqrt{\frac{a^2 - b^2}{a^2}} = \frac{\sqrt{7}}{4}$

$S\left(\pm\sqrt{7}, 0\right)\ C\left(0,3\right)$

$r = \sqrt{7+9} = 4$

$(x-0)^2 + (y-3)^2 = 16$

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This question paper was set by senior Lecturers at

Sri Chaitanya Educational Institutions