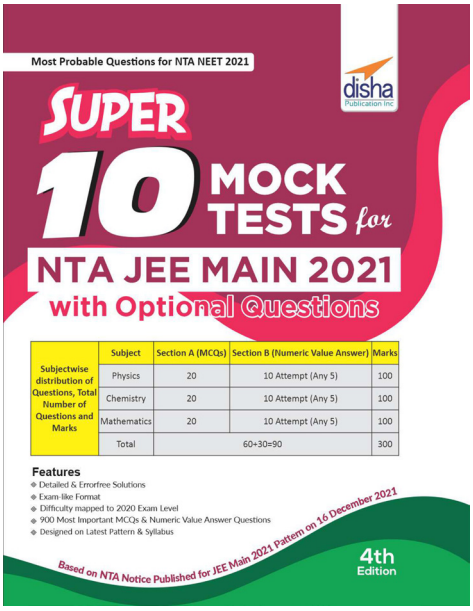
Mock Test

This Section is taken from the Book:



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Mock Test 1

Time : 3 hrs. **Max. Marks : 300**

INSTRUCTIONS

1. This test will be a 3 hours Test.
2. This test consists of Physics, Chemistry and Mathematics questions with equal weightage of 100 marks.
3. Each question is of 4 marks.
4. There are three parts in the question paper consisting of Physics (Q.no.1 to 30), Chemistry (Q.no.31 to 60) and Mathematics (Q. no.61 to 90). Each part is divided into two sections, Section A consists of 20 multiple choice questions & Section B consists of 10 Numerical value answer Questions.
   In Section B, candidates have to attempt **only 5 questions out of 10**.
5. There will be only one correct choice in the given four choices in Section A. For each question 4 marks will be awarded for correct choice, 1 mark will be deducted for incorrect choice and zero mark will be awarded for unattempted question. For Section B 4 marks will be awarded for correct answer and zero for marked for each review / unattempted/incorrect answer.
6. Any textual, printed or written material, mobile phones, calculator etc. is not allowed for the students appearing for the test.
7. All calculations / written work should be done in the rough sheet provided.

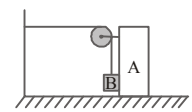
PHYSICS

Section - A

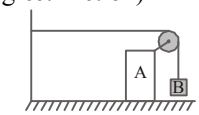
1. Two balls of same mass and carrying equal charge are hung by threads of length l from a fixed support. At electrostatic equilibrium, assuming that angles made by each thread is small, the separation, x between the balls is proportional to :

   (1) l (2) l^2 (3) $l^{2/3}$ (4) $l^{1/3}$

2. A 20 kg block B is suspended from a cord attached to a 40 kg cart A. Find the ratio of the acceleration of block in cases (i) and (ii) shown in the figure immediately after the system is released from rest. (neglect friction)



Case (i)

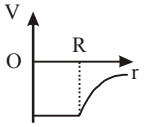


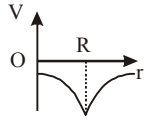
Case (ii)

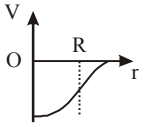
Space for Rough Work

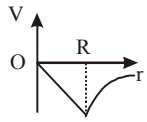
(1) $\frac{\sqrt{2}}{3}$ (2) $3\sqrt{2}$ (3) $\frac{3}{2}$ (4) $\frac{3}{2\sqrt{2}}$

3. The diagram showing the variation of gravitational potential of earth with distance from the centre of earth is

(1) 

(2) 

(3) 

(4) 

4. In "Al" and "Si", if temperature is changed from normal temperature to 70 K then
   (1) The resistance of Al will increase and that of Si will decrease
   (2) The resistance of Al will decrease and that of Si will increase
   (3) Resistance of both decrease
   (4) Resistance of both increase

5. Two rods of length d_1 and d_2 and coefficients of thermal conductivities K_1 and K_2 are kept touching each other. Both have the same area of cross-section, the equivalent thermal conductivity is

(1) $K_1 + K_2$ (2) $K_1d_1 + K_2d_2$

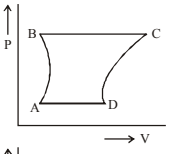
(3) $\frac{d_1K_1 + d_2K_2}{d_1 + d_2}$ (4) $\frac{d_1 + d_2}{(d_1/K_1 + d_2/K_2)}$

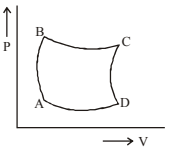
6. Charge q is uniformly spread on a thin ring of radius R. The ring rotates about its axis with a uniform frequency f Hz. The magnitude of magnetic induction at the centre of the ring is

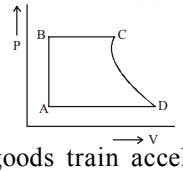
(1) $\frac{\mu_0 qf}{2R}$ (2) $\frac{\mu_0 q}{2f R}$

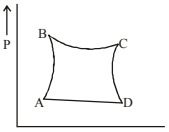
(3) $\frac{\mu_0 q}{2\pi f R}$ (4) $\frac{\mu_0 qf}{2\pi R}$

7. A certain amount of gas is taken through a cyclic process (ABCDA) that has two isobars, one isochore and one isothermal. The cycle can be represented on a P-V indicator diagram as :

(1) 

(2) 

(3) 

(4) 

8. A goods train accelerating uniformly on a straight railway track, approaches an electric pole standing on the side of track. Its engine passes the pole with velocity u and the guard's room passes with velocity v. The middle wagon of the train passes the pole with a velocity.

(1) $\frac{u \quad v}{2}$ (2) $\frac{1}{2}\sqrt{u^2 \quad v^2}$

(3) $\sqrt{uv}$ (4) $\sqrt{\left(\frac{u^2 \quad v^2}{2}\right)}$

9. A wheel is rotating at 900 r.p.m. about its axis. When power is cut off it comes to rest in 1 minute. The angular retardation in rad/s^2 is

(1) $\pi/2$ (2) $\pi/4$
(3) $\pi/6$ (4) $\pi/8$

10. Two springs of force constants 300 N/m (Spring A) and 400 N/m (Spring B) are joined together in series. The combination is compressed by 8.75 cm. The ratio of energy stored in A and B is $\frac{E_A}{E_B}$. Then $\frac{E_A}{E_B}$ is equal to :

(1) $\frac{4}{3}$ (2) $\frac{16}{9}$

(3) $\frac{3}{4}$ (4) $\frac{9}{16}$

11. A particle of mass m is acted upon by a force F given by the empirical law $F \quad \frac{R}{t^2}$ v(t). If this law is to be tested experimentally by observing the motion starting from rest, the best way is to plot :

(1) log v(t) against $\frac{1}{t}$ (2) v(t) against t^2

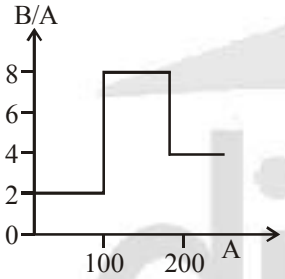
(3) log v(t) against $\frac{1}{t^2}$ (4) log v(t) against t

12. In case of a p-n junction diode at high value of reverse bias, the current rises sharply. The value of reverse bias is known as

(1) cut off voltage (2) zener voltage

(3) inverse voltage (4) critical voltage

13. Assume that the nuclear binding energy per nucleon (B/A) versus mass number (A) is as shown in the figure. Use this plot to choose the correct choice(s) given below.



(1) Fusion of two nuclei with mass numbers lying in the range of $1 < A < 50$ will release energy

(2) Fusion of two nuclei with mass numbers lying in the range of $51 < A < 100$ will release energy

(3) Fission of a nucleus lying in the mass range of $100 < A < 200$ will release energy when broken into two equal fragments

(4) Fission of a nucleus lying in the mass range of $120 < A < 180$ will release energy when broken into two equal fragments

14. If 10% of a radioactive material decays in 5 days, then the amount of the original material left after 20 days is approximately

(1) 60% (2) 66%

(3) 70% (4) 75%

15. When white light passes through a dispersive medium, it breaks up into various colours. Which of the following statements is true?

(1) Velocity of light for violet is greater than the velocity of light for red colour.

(2) Velocity of light for violet is less than the velocity of light for red.

(3) Velocity of light is the same for all colours

(4) Velocity of light for different colours has nothing to do with the phenomenon of dispersion

16. A plate of mass (M) is placed on a horizontal frictionless surface and a body of mass (m) is placed on this plate. The coefficient of dynamic friction between this body and the plate is μ. If a force 3μmg is applied to the body of mass (m) along the horizontal, the acceleration of the plate will be

(1) $\frac{\mu m}{M} g$ (2) $\frac{\mu mg}{M+m}$

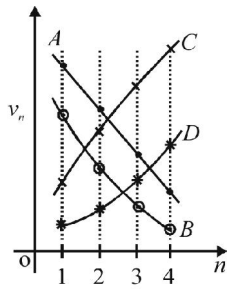
(3) $\frac{3\mu mg}{M}$ (4) $\frac{2\mu mg}{M+m}$

17. Lights of two different frequencies, whose photons have energies 1 eV and 2.5 eV respectively, successively illuminate a metal whose work function is 0.5 eV. The ratio of the maximum speeds of the emitted electrons will be

(1) 1 : 5 (2) 1 : 4

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

18. Which of the plots shown in the figure represents speed (v_n) of the electron in a hydrogen atom as a function of the principal quantum number (n)?



(1) *B* (2) *D*

(3) *C* (4) *A*

19. An engine has an efficiency of 1/6. When the temperature of sink is reduced by 62°C, its efficiency is doubled. Temperatures of source and sink are

(1) 99°C, 37°C (2) 124°C, 62°C

(3) 37°C, 99°C (4) 62°C, 124°C

20. A sinusoidal voltage of peak value 283 V and angular frequency 320/s is applied to a series LCR circuit. Given that R = 5 Ω, L= 25 mH and C = 1000 μF. The total impedance, and phase difference between the voltage across the source and the current will respectively be :

(1) 10 Ω and $\tan^{-1}\left(\frac{5}{3}\right)$

(2) 7 Ω and 45°

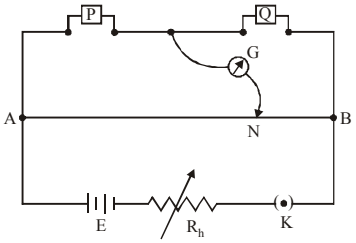
(3) 10 Ω and $\tan^{-1}\left(\frac{8}{3}\right)$

(4) 7 Ω and $\tan^{-1}\left(\frac{5}{3}\right)$

Section - B

21. A toy–car, blowing its horn, is moving with a steady speed of 5 m/s, away from a wall. An observer, towards whom the toy car is moving, is able to hear 5 beats per second. If the velocity of sound in air is 340 m/s, the frequency of the horn of the toy car is close to _____ Hz.

22. In a meter bridge experiment resistances are connected as shown in the figure. Initially resistance P = 4 Ω and the neutral point N is at 60 cm from A. Now an unknown resistance R is connected in series to P and the new position of the neutral point is at 80 cm from A. The value of unknown resistance R is _____ohm.

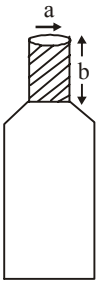


23. The circular head of a screw gauge is divided into 200 divisions and move 1 mm ahead in one revolution. If the same instrument has a zero error of –0.05 mm and the reading on the main scale in measuring diameter of a wire is 6 mm and that on circular scale is 45. The diameter of the wire is _____ mm.

24. The radius of curvature of a thin plano-convex lens is 20 cm (of curved surface) and the refractive index is 1.5. If the plane surface is silvered, then it behaves like a concave mirror of focal length _____ cm.

25. Three resistors of 4 Ω, 6 Ω and 12 Ω are connected in parallel and the combination is connected in series with a 1.5 V battery of 1 Ω internal resistance. The rate of Joule heating in the 4 Ω resistor is _____ watt.

26. A bottle has an opening of radius a and length b. A cork of length b and radius $(a+\Delta a)$ where $(\Delta a << a)$ is compressed to fit into the opening completely (see figure). If the bulk modulus of cork is B and frictional coefficient between the bottle and cork is μ then the force needed to push the cork into the bottle is $(x\pi\mu Bb)\Delta A$.



Find the value of *x*.

27. A sinusoidal voltage of amplitude 25 volt and frequency 50Hz is applied to a half wave rectifier using P-n junction diode. No filter is used and the load resistor is 1000W. The forward resistance R_f of ideal diode is 10W. The percentage rectifier efficiency is _____.

28. An insect trapped in a circular groove of radius 12 cm moves along the groove steadily and completes 7 revolutions in 100 sec. What is the linear speed (in cm/s) of the motion?

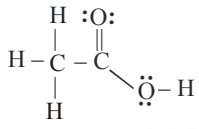
29. The magnetic field of earth at the equator is approximately 4×10^{-5} T. The radius of earth is 6.4×10^6 m. Then the dipole moment of the earth of the order of 10^x Am^2. Find the value of x.

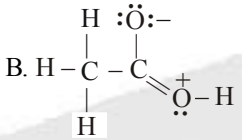
30. A particle starts S.H.M. from the mean position. Its amplitude is a and total energy E. At one instant its kinetic energy is 3E/4, its displacement at this instant is y $\frac{a}{x}$. Find the value of x.

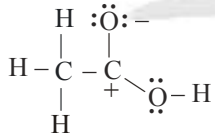
CHEMISTRY

Section - A

31. Which of the following resonance structure is lowest in energy?

A. 

B. 

C. 

(1) A
(2) B
(3) C
(4) All have same energy

32. Which of the following pairs have identical bond order ?

(1) N_2, O_2^{2+} (2) N_2, O_2^-
(3) N_2^-, O_2 (4) O^{2+}, N_2

33. In a compound AOH, electronegativity of 'A' is 2.1, the compound would be

(1) Acidic
(2) Neutral towards acid & base
(3) Basic
(4) Amphoteric

34. Which of the following orders is wrong?

(1) Electron affinity– N < O < F < Cl
(2) Ist ionisation potential – Be < B < N < O
(3) Basic property– MgO < CaO < FeO < Fe_2O_3
(4) Reactivity–Be < Li < K < Cs

35. The following species will not exhibit disproportionation reaction

(1) ClO^- (2) ClO_2^-
(3) ClO_3^- (4) ClO_4^-

36. Given, $HF + H_2O \xrightarrow{K_a} H_3O^+ + F^-$;

$F^- + H_2O \xrightarrow{K_b} HF + OH^-$.

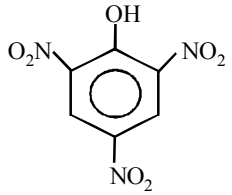
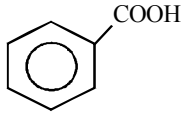
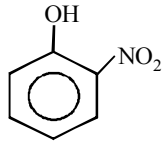
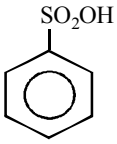
Which relation is correct ?

(1) $K_b = K_w$ (2) $K_b = \frac{1}{K_w}$
(3) $K_a \times K_b = K_w$ (4) $\frac{K_a}{K_b} = K_w$

37. The oxidation states of sulphur in the anions SO_3^{2-}, $S_2O_4^{2-}$ and $S_2O_6^{2-}$ follow the order

(1) $SO_3^{2-} < S_2O_4^{2-} < S_2O_6^{2-}$
(2) $S_2O_4^{2-} < S_2O_6^{2-} < SO_3^{2-}$
(3) $S_2O_6^{2-} < S_2O_4^{2-} < SO_3^{2-}$
(4) $S_2O_4^{2-} < SO_3^{2-} < S_2O_6^{2-}$

38. Among the electrolytes Na_2SO_4, $CaCl_2$, $Al_2(SO_4)_3$ and NH_4Cl, the most effective coagulating agent for Sb_2S_3 sol is
(1) Na_2SO_4 (2) $CaCl_2$
(3) $Al_2(SO_4)_3$ (4) NH_4Cl

39. Which of the following will not be soluble in sodium carbonate solution?
(1) 
(2) 
(3) 
(4) 

40. Although Al has a high oxidation potential it resists corrosion because of the formation of a tough, protective coat of
(1) $Al(NO_3)_2$ (2) AlN
(3) Al_2O_3 (4) $Al_2(CO_3)_2$

41. Which is used as medicine?
(1) PVC (2) Terylene
(3) Glyptal (4) Urotropine

42. In Lassaigne's test, the organic compound is fused with a piece of sodium metal in order to
(1) increase the ionisation of the compound
(2) decrease the melting point of the compound
(3) increase the reactivity of the compound
(4) convert the covalent compound into a mixture of ionic compounds

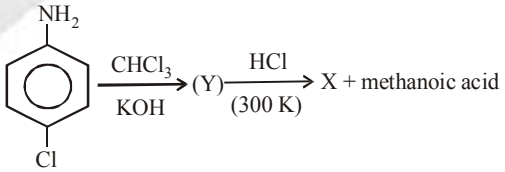
43. An aqueous solution of colourless metal sulphate M gives a white precipitate with NH_4OH. This was soluble in excess of NH_4OH. On passing H_2S through this solution a white ppt. is formed. The metal M in the salt is
(1) Ca (2) Ba
(3) Al (4) Zn

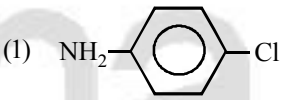
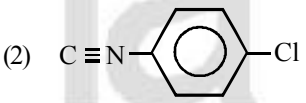
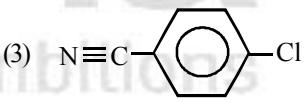
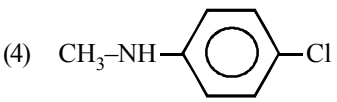
44. Which of the following oxidising reaction of $KMnO_4$ occurs in acidic medium?
(i) Fe^{2+} (green) is converted to Fe^{3+} (yellow).
(ii) Iodide is converted to iodate.
(iii) Thiosulphate oxidised to sulphate.
(iv) Nitrite is oxidised to nitrate.
(1) (i) and (iii) (2) (i) and (iv)
(3) (iv) only (4) (ii) and (iv)

45. Which of the following compound cannot be used in preparation of iodoform?
(1) CH_3CHO (2) CH_3COCH_3
(3) HCHO (4) 2-propanol

46. Anhydrous $AlCl_3$ cannot be obtained from which of the following reactions ?
(1) Heating $AlCl_3.6H_2O$
(2) By passing dry HCl over hot aluminium powder
(3) By passing dry Cl_2 over hot aluminium powder
(4) By passing dry Cl_2 over a hot mixture of alumina and coke

47. Identify X in the sequence given :

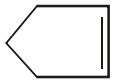


(1) 
(2) 
(3) 
(4) 

48. Select the rate law that corresponds to the data shown for the following reaction $A + B \longrightarrow C$

Expt. No.	[A]	[B]	Initial Rate
(i)	0.012	0.035	0.10
(ii)	0.024	0.070	0.80
(iii)	0.024	0.035	0.10
(iv)	0.012	0.070	0.80

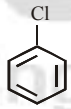
(1) Rate = $K[B]^3$ (2) Rate = $K[B]^4$
(3) Rate = $K[A][B]^3$ (4) Rate = $K[A]^2[B]^2$

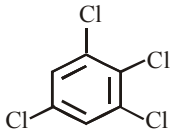
49. An alkene upon ozonolysis yield $CHO-CH_2-CH_2-CH_2-CHO$ only. The alkene is
(1) $CH_2=CH-CH_2-CH_2-CH_2-CH_2-CH_3$
(2) 
(3) 
(4) 

50. An inorganic compound gives off O_2 when heated, turns an acidic solution of KI violet and reduces acidified $KMnO_4$. The compound is
(1) SO_3 (2) KNO_3
(3) H_2O_2 (4) All of these

Section - B

51. Ionization energy of gaseous Na atoms is 495.5 kJ mol^{-1}. Calculate the lowest possible frequency of light that ionizes a sodium atom in terms of $x \times 10^{15} s^{-1}$
($h = 6.626 \times 10^{-34}$ Js, $N_A = 6.022 \times 10^{23}$ mol^{-1})

52. The dipole moment of chlorobenzene  is 1.5 D. Find the dipole moment of



53. If 3.01×10^{20} molecules are removed from 98 mg of H_2SO_4, then calculate the number of moles of H_2SO_4 left in terms of $x \times 10^{-3}$.

54. The initial volume of a gas cylinder is 750.0 mL. If the pressure of gas inside the cylinder changes from 840.0 mm Hg to 360.0 mm Hg, calculate the final volume of the gas.

55. In an amino acid, the carboxyl group ionises at $pK_{a_1} = 2.34$ and ammonium ion at $pK_{a_2} = 9.60$. Find the isoelectric point (pI) of the amino acid

56. AB, A_2 and B_2 are diatomic molecules. If the bond enthalpies of A_2, AB and B_2 are in the ratio 1:1 :0.5 and enthalpy of formation of AB from A_2 and B_2 is -100 kJ mol^{-1}. Calculate the bond energy of A_2

57. A 5.25% solution of a substance is isotonic with a 1.5% solution of urea (molar mass = 60 g mol^{-1}) in the same solvent. If the densities of both the solutions are assumed to be equal to 1.0 g cm^{-3}, calculate molar mass of the substance

58. If the following half cells have the E° values as $Fe^{+3} + e^- \longrightarrow Fe^{+2}$; E° = + 0.77V and $Fe^{+2} + 2e^- \longrightarrow Fe$; E° = – 0.44V. Calculate the E° of the half cell $Fe^{+3} + 3e^- \longrightarrow Fe$

59. What is the oxidation number of Mn in the product of alkaline oxidative fusion of MnO_2.

60. A solid AB crystallises as NaCl structure and the radius of the cation is 0.100nm. Calculate the maximum radius of the anion

MATHEMATICS

Section - A

61. If $2\sec 2\alpha = \tan\beta + \cot\beta$ then one of the values of $(\alpha+\beta)$ =

(1) π (2) $\frac{\pi}{2}$

(3) $\frac{\pi}{4}$ (4) None

62. The value of $\sum_{r=1}^{5} r\frac{{}^{n}C_{r}}{{}^{n}C_{r-1}}$ =

(1) $5(n-3)$ (2) $5(n-2)$

(3) $5n$ (4) $5(2n-9)$

63. ${}^{14}C_7 + \sum_{i=1}^{3} {}^{17-i}C_6$ =

(1) ${}^{16}C_7$ (2) ${}^{17}C_7$

(3) ${}^{17}C_8$ (4) ${}^{16}C_8$

64. If $e^{y}(x+1)=1$, then, $\frac{d^2y}{dx^2}$ is

(1) $\frac{dy}{dx}$ (2) $\left(\frac{dy}{dx}\right)^2$

(3) $\left(\frac{dy}{dx}\right)^3$ (4) 1

65. Let ABC be a triangle with vertices at points A (2, 3, 5), B (–1, 3, 2) and C (λ, 5, μ) in three dimensional space. If the median through A is equally inclined with the axes, then (λ, μ) is equal to :

(1) (10, 7) (2) (7, 5)

(3) (7, 10) (4) (5, 7)

66. The angle between the two lines $\frac{x+1}{2}=\frac{y+3}{2}=\frac{z-4}{-1}$ & $\frac{x-4}{1}=\frac{y+4}{2}=\frac{z+1}{2}$ is

(1) $\cos^{-1}\left(\frac{4}{9}\right)$ (2) $\cos^{-1}\left(\frac{3}{9}\right)$

(3) $\cos^{-1}\left(\frac{2}{9}\right)$ (4) $\cos^{-1}\left(\frac{1}{9}\right)$

67. The contrapositive of $(p\vee q)\Rightarrow r$ is

(1) $r\Rightarrow(p\vee q)$ (2) $\sim r\Rightarrow(p\vee q)$

(3) $\sim r\Rightarrow \sim p\wedge\sim q$ (4) $p\Rightarrow(q\vee r)$

68. If (2, 3, 5) are ends of the diameter of a sphere $x^2+y^2+z^2-6x-12y-2z+20=0$. Then coordinates of the other end are

(1) (4, 9, –3) (2) (4, 3, 5)

(3) (4, 3, –3) (4) (4, –3, 9)

69. $\int \frac{dx}{(x-\beta)\sqrt{(x-\alpha)(\beta-x)}}$ is

(1) $\frac{2}{\alpha-\beta}\sqrt{\frac{x-\alpha}{\beta-x}}+C$

(2) $\frac{2}{\alpha-\beta}\sqrt{(x-\alpha)(\beta-x)}+C$

(3) $\frac{\alpha-\beta}{2}(x-\alpha)\sqrt{\beta-x}$

(4) None of these.

70. Consider the following planes

$P: x+y-2z+7=0$

$Q: x+y+2z+2=0$

$R: 3x+3y-6z-11=0$

(1) P and R are perpendicular
(2) Q and R are perpendicular
(3) P and Q are parallel
(4) P and R are parallel

71. If $\frac{1}{1^4}\ \frac{1}{2^4}\ \frac{1}{3^4}\ .....\ \infty\ \frac{\pi^4}{90}$, then the value of $\frac{1}{1^4}\ \frac{1}{3^4}\ \frac{1}{5^4}\ .....\infty$ is

(1) $\frac{\pi^4}{96}$ (2) $\frac{\pi^4}{45}$

(3) $\frac{89}{90}\pi^4$ (4) None of these

72. The domain of the function

$f(x) = \exp(\sqrt{5x-3-2x^2})$ is

(1) $[3/2, \infty)$ (2) $[1, 3/2]$
(3) $(-\infty, 1]$ (4) $(1, 3/2)$

73. The value of the determinant

$$\begin{vmatrix} 1 & a & a^2 \\ \cos(n-1)x & \cos nx & \cos(n+1)x \\ \sin(n-1)x & \sin nx & \sin(n+1)x \end{vmatrix}$$ is zero, if $a \neq 1$

(1) $\sin x = 0$ (2) $\cos x = 0$

(3) $a = 0$ (4) $\cos x = \frac{1+a^2}{2a}$

74. If $a = \cos\left(\frac{2\pi}{7}\right) + i\sin\left(\frac{2\pi}{7}\right)$, then the quadratic equation whose roots are $\alpha = a + a^2 + a^4$ and $\beta = a^3 + a^5 + a^6$, is

(1) $x^2 - x + 2 = 0$ (2) $x^2 + x - 2 = 0$
(3) $x^2 - x - 2 = 0$ (4) $x^2 + x + 2 = 0$

75. If $AB = 0$, then for the matrices

$A = \begin{bmatrix} \cos^2\theta & \cos\theta\sin\theta \\ \cos\theta\sin\theta & \sin^2\theta \end{bmatrix}$ and

$B = \begin{bmatrix} \cos^2\phi & \cos\phi\sin\phi \\ \cos\phi\sin\phi & \sin^2\phi \end{bmatrix}$, $\theta - \phi$ is

(1) an odd multiple of $\frac{\pi}{2}$
(2) an odd multiple of π
(3) an even multiple of $\frac{\pi}{2}$
(4) 0

76. If $f(x) = xe^{x(1-x)}$, $x \in R$, then $f(x)$ is

(1) decreasing on $[-1/2, 1]$
(2) decreasing on R
(3) increasing on $[-1/2, 1]$
(4) increasing on R

77. The area bounded by the curves $x = y^2$ and $x = \frac{2}{1+y^2}$ is

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

(3) $-\pi - \frac{2}{3}$ (4) None of these

78. An inverted cone is 10 cm in diameter and 10 cm deep. Water is poured into it at the rate of $4 cm^3/min$. When the depth of water level is 6 cm, then it is rising at the rate

(1) $\frac{9}{4\pi} cm^3/min.$ (2) $\frac{1}{4\pi} cm^3/min.$

(3) $\frac{1}{9\pi} cm^3/min.$ (4) $\frac{4}{9\pi} cm^3/min.$

79. The equation of tangent to $4x^2 - 9y^2 = 36$ which is perpendicular to straight line $5x + 2y - 10 = 0$ is

(1) $5(y-3) = 2\left(x - \frac{\sqrt{117}}{2}\right)$

(2) $2y - 5x + 10 - 2\sqrt{18} = 0$

(3) $2y - 5x - 10 - 2\sqrt{18} = 0$

(4) None of these

80. $\int_{\log\sqrt{\pi/2}}^{\log\sqrt{\pi}} e^{2x} \sec^2\left(\frac{1}{3}e^{2x}\right)dx$ is equal to :

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

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

Section - B

81. If $a_1, a_2, a_3, \ldots\ldots\ldots$ are positive numbers in G.P. then the value of

$$\begin{vmatrix} \log a_n & \log a_{n+1} & \log a_{n+2} \\ \log a_{n+1} & \log a_{n+2} & \log a_{n+3} \\ \log a_{n+2} & \log a_{n+3} & \log a_{n+4} \end{vmatrix}$$ is _____.

82. The probability that in the random arrangement of the letters of the word 'UNIVERSITY', the two I's does not come together is _____.

83. A point is selected at random from the interior of a circle. The probability that the point is close to the centre, than the boundary of the circle, is _____.

84. Three persons A, B, C throw a die in succession. The one getting 'six' wins. If A starts then the probability of B winning is _____.

85. If the foci of the ellipse $\frac{x^2}{16} \quad \frac{y^2}{b^2} \quad 1$ coincide with the foci of the hyperbola $\frac{x^2}{144} - \frac{y^2}{81} \quad \frac{1}{25}$, then value of b^2 is _____.

86. If $f(x) = |x-2|$ and $g(x) = f(f(x))$ then for $x > 10$, $g'(x)$ is.

87. If ab^2c^3, $a^2b^3c^4$, $a^3b^4c^5$ are in A.P. $(a, b, c > 0)$, then the minimum value of $a + b + c$ is.

88. The sum of the coefficients in the expansion of $\left(x^2 - \frac{1}{3}\right)^{199} \times \left(x^3 \quad \frac{1}{2}\right)^{200}$ is _____.

89. If the median and the range of four numbers $\{x, y, 2x+y, x-y\}$, where $0 < y < x < 2y$, are 10 and 28 respectively, then the mean of the numbers is _____.

90. If $\int \frac{dx}{\cos^3 x\sqrt{2\sin 2x}} \quad (\tan x)^A \quad C(\tan x)^B \quad k$, where k is a constant of integration, then value of $A + B + C$ is _____.

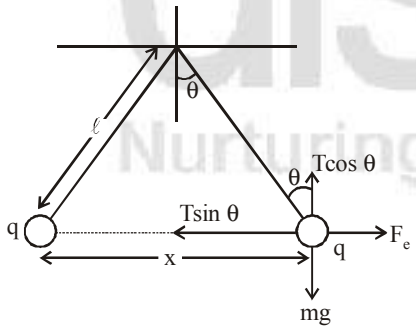
Mock Test-1

ANSWER KEY											
1	(4)	**16**	(1)	**31**	(1)	**46**	(1)	**61**	(3)	**76**	(3)
2	(4)	**17**	(3)	**32**	(1)	**47**	(1)	**62**	(2)	**77**	(1)
3	(3)	**18**	(1)	**33**	(2)	**48**	(1)	**63**	(2)	**78**	(4)
4	(2)	**19**	(1)	**34**	(2)	**49**	(2)	**64**	(2)	**79**	(4)
5	(4)	**20**	(2)	**35**	(4)	**50**	(3)	**65**	(3)	**80**	(1)
6	(1)	**21**	(170)	**36**	(3)	**51**	(1.24)	**66**	(1)	**81**	(0)
7	(3)	**22**	(6.67)	**37**	(4)	**52**	(2.25)	**67**	(3)	**82**	(0.80)
8	(4)	**23**	(6.275)	**38**	(3)	**53**	(0.5)	**68**	(1)	**83**	(0.25)
9	(1)	**24**	(20)	**39**	(3)	**54**	(1.75)	**69**	(1)	**84**	(0.33)
10	(1)	**25**	(0.25)	**40**	(3)	**55**	(5.97)	**70**	(4)	**85**	(7.00)
11	(1)	**26**	(4)	**41**	(4)	**56**	(400)	**71**	(1)	**86**	(1.00)
12	(2)	**27**	(40.05)	**42**	(4)	**57**	(210)	**72**	(2)	**87**	(3.00)
13	(2)	**28**	(5.3)	**43**	(4)	**58**	(0.04)	**73**	(1)	**88**	(1.50)
14	(2)	**29**	(23)	**44**	(2)	**59**	(6)	**74**	(4)	**89**	(14.00)
15	(2)	**30**	(2)	**45**	(3)	**60**	(0.241)	**75**	(1)	**90**	(3.20)

Solutions

PHYSICS

1. (4)



In equilibrium, $F_e = T\sin\theta$

$mg = T\cos\theta$

$\tan\theta = \frac{F_e}{mg} = \frac{q^2}{4\pi\epsilon_0 x^2 \times mg}$

also $\tan\theta = \sin\frac{x/2}{\ell}$

Hence, $\frac{x}{2\ell} = \frac{q^2}{4\pi\epsilon_0 x^2 \times mg}$

$\Rightarrow x^3 = \frac{2q^2\ell}{4\pi\epsilon_0 mg}$

$\therefore x = \left(\frac{q^2\ell}{2\pi\epsilon_0 mg}\right)^{1/3}$

Therefore $x \propto \ell^{1/3}$

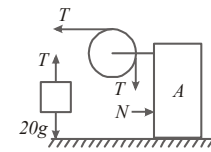
2. (4) **Case I :**

$T - N = 40a$

and $20g - T = 20a$

Also $N = 20a$

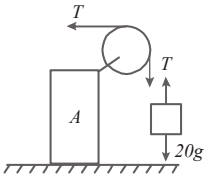
After simplifying, we get



$$a = \frac{g}{4}$$

Acceleration of block B, $= \sqrt{2}a \quad \frac{g}{2\sqrt{2}}$.

Case II :



$T = 40\,a$

and $20\,g - T = 20\,a$

After simplifying above equation, we get

$a = g/3$

$$\text{Ratio} = \frac{g/2\sqrt{2}}{g/3} \quad \frac{3}{2\sqrt{2}}.$$

3. (3) $V_{in} = \frac{-GM}{2R}\left[3 - \left(\frac{r}{R}\right)^2\right]$,

$V_{surface} \quad \frac{-GM}{R}, V_{out} \quad \frac{-GM}{r}$

4. (2) T ↓ (300K to 70K)

T ↓ R_{metal} ↓ R ↑ semi-conductor

(Al) (Si)

5. (4) When two rods are connected in series

$$Q \quad \frac{A(T_1 - T_2)t}{\frac{d_1}{K_1} \quad \frac{d_2}{K_1}} \quad \frac{A(T_1 - T_2)t}{(d_1 \quad d_2)/K}$$

$$\therefore \quad \frac{d_1 \quad d_2}{K} \quad \frac{d_1}{K_1} \quad \frac{d_2}{K_2};$$

$$\therefore \quad K \quad \frac{(d_1 \quad d_2)}{\frac{d_1}{K_1} \quad \frac{d_2}{K_2}}$$

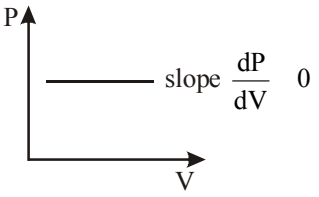
6. (1) When the ring rotates about its axis with a uniform frequency f Hz, the current flowing in the ring is

$$I \quad \frac{q}{T} \quad qf$$

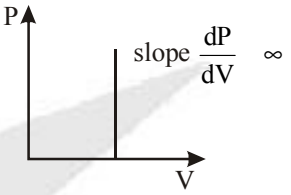
Magnetic field at the centre of the ring is

$$B = \frac{\mu_0 I}{2R} = \frac{\mu_0 qf}{2R}$$

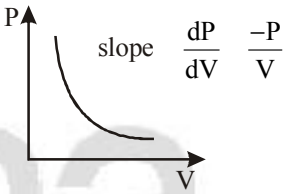
7. (3) P-V indicator diagram for isobaric



P-V indicator diagram for isochoric process



P-V indicator diagram for isothermal process



8. (4) Let '*S*' be the distance between two ends '*a*' be the constant acceleration

As we know $v^2 - u^2 = 2aS$

or, $aS = \frac{v^2 - u^2}{2}$

Let v_c be velocity at mid point.

Therefore, $v_c^2 - u^2 \quad 2a\frac{S}{2}$

$v_c^2 \quad u^2 \quad aS$

$v_c^2 \quad u^2 \quad \frac{v^2 - u^2}{2}$

$$v_c = \sqrt{\frac{u^2 \quad v^2}{2}}$$

9. (1) Angular retardation,

$$\alpha = \frac{\omega_2 - \omega_1}{t} = \frac{2\pi(n_2 - n_1)}{t} = \frac{2\pi(0 - 900/60)}{60} = -\frac{\pi}{2}\text{rad/s}^2.$$

10. (1) Given : $k_A = 300\,N/m$, $k_B = 400\,N/m$

Let when the combination of springs is compressed by force F. Spring A is compressed by x_A. Therefore compression in spring B

$x_B = (8.75 - x_A)$ cm

$F = 300 \times x_A = 400(8.75 - x_A)$

Solving we get, $x_A = 5$ cm

$x_B = 8.75 - 5 = 3.75$ cm

$$\frac{E_A}{E_B} = \frac{\frac{1}{2}k_A(x_A)^2}{\frac{1}{2}k_B(x_B)^2} = \frac{300\times(5)^2}{400\times(3.75)^2} = \frac{4}{3}$$

11. (1) From $F = \frac{R}{t^2}v(t) \Rightarrow m\frac{dv}{dt} = \frac{R}{t^2}v(t)$

Integrating both sides $\int\frac{dv}{v(t)} = \int\frac{Rdt}{mt^2}$

$$\ln v = -\frac{R}{mt}$$

$$\therefore \ln v \propto \frac{1}{t}$$

12. (2) In reverse bias on p-n junction when high voltage is applied, electric break down of junction takes place, resulting large increase in reverse current. This high voltage applied is called zener voltage.

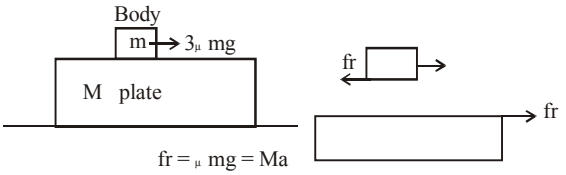
13. (2) If in nuclear reaction binding energy per nucleon increases, energy is released.

14. (2) Let initial amount be 100 gm.

		disintegrated	Left
100 gm	$\xrightarrow{5\text{ days}}$ $\frac{100\times10}{100}$	10	90
90	$\xrightarrow{\text{Next }5\text{ days}}$ $\frac{90\times10}{100}$	9	81
81	$\xrightarrow{\text{Next }5\text{ days}}$ $\frac{81\times10}{100}$	8.1	= 73
73	$\xrightarrow{\text{Next }5\text{ days}}$ $\frac{73\times10}{100}$	7.3	= 66

15. (2) As $\mu_v > \mu_r$ therefore, $v_v < v_r$.

16. (1) $a = \frac{\mu mg}{M}$



17. (3) Einstein equation $KE_{max} = E - \text{Work function}$;

$$\frac{1}{2}mv^2 = E - W$$

Using this concept,

$$\frac{\frac{1}{2}mV_1^2\,max}{\frac{1}{2}mV_2^2\,max} = \frac{1-.5}{2.5-.5} = \frac{1}{4} \text{ or } \frac{V_1\,max}{V_2\,max} = \frac{1}{2}$$

18. (1) Velocity of electron in n^{th} orbit of hydrogen atom is given by :

$$V_n = \frac{2\pi KZe^2}{nh}$$

Substituting the values we get,

$$V_n = \frac{2.2\times10^6}{n}\text{m/s} \quad \text{or} \quad V_n \propto \frac{1}{n}$$

As principal quantum number increases, velocity decreases.

19. (1) From $\eta = 1 - \frac{T_2}{T_1}$, $\frac{T_2}{T_1} = 1-\eta = 1-\frac{1}{6} = \frac{5}{6}$ ...(i)

In 2nd case :

$$\frac{T_2 - 62}{T_1} = 1-\eta' = 1-\frac{2}{6} = \frac{2}{3} \quad .....(ii)$$

Using (i), $T_2 - 62 = \frac{2}{3}T_1 = \frac{2}{3}\times\frac{6}{5}T_2 = \frac{4}{5}T_2$

or $\frac{1}{5}T_2$ 62, $T_2 = 310\,K = 310 - 273 = 37°C$

T_1 $\frac{6}{5}T_2$ $\frac{6}{5} \times 310$ 372K

$= 372 - 273$ 99 C

20. (2) Given,

$V_0 = 283$ volt, $\omega = 320, R = 5\,\Omega$, $L = 25$ mH, $C = 1000\,\mu F$

$X_L = \omega L = 320 \times 25 \times 10^{-3} = 8\,\Omega$

X_C $\frac{1}{\omega C}$ $\frac{1}{320 \times 1000 \times 10^{-6}}$ $3.1\,\Omega$

Total impedance of the circuit :

Z $\sqrt{R^2 \quad (X_L - X_C)^2}$ $\sqrt{25 \quad (4.9)^2}$ $7\,\Omega$

Phase difference between the voltage and current

$\tan\phi$ $\frac{X_L - X_C}{R}$

$\tan\phi = \frac{4.9}{5} \approx 1 \Rightarrow \phi$ 45

21. (170) From Doppler's effect

$$f(\text{direct}) = f\left(\frac{340}{340-5}\right) = f_1$$

$$f(\text{by wall}) = f\left(\frac{340}{340+5}\right) = f_2$$

Beats $= (f_1 - f_2)$

$$5 = f\left(\frac{340}{340-5} - \frac{340}{340+5}\right)$$

$\Rightarrow f = 170$ Hz.

22. (6.67) In balance position of bridge,

$\frac{P}{Q}$ $\frac{l}{(100-l)}$

Initially neutral position is 60 cm from A, so

$\frac{4}{60} = \frac{Q}{40} \Rightarrow Q$ $\frac{16}{6}$ $\frac{8}{3}\,\Omega$

Now, when unknown resistance R is connected in series to P, neutral point is 80 cm from A then,

$\frac{4}{80}$ $\frac{R}{\quad}$ $\frac{Q}{20}$

$\frac{4}{80}$ $\frac{R}{\quad}$ $\frac{8}{60}$

$R = \frac{64}{6} - 4$ $\frac{64-24}{6}$ $\frac{40}{6}\,\Omega$

Hence, the value of unknown resistance R is $\frac{20}{3}\,\Omega$

23. (6.275) Pitch = 1 mm

Number of divisions on circular scale = 200

$$\text{L.C} = \frac{\text{Pitch}}{\text{Number of divisions on circular scale}}$$

$= \frac{1\text{ mm}}{200} = 0.005\text{ mm} = 0.0005\text{ cm}$

Diameter of the wire = (Main scale reading + Circular scale reading × L.C.) – zero error

$= 6\text{ mm} + 45 \times 0.005 - (-0.05)$

$= 6\text{ mm} + 0.225\text{ mm} + 0.05\text{ mm} = 6.275\text{ mm}$

24. (20) The silvered plano convex lens behaves as a concave mirror; whose focal length is given by

$\frac{1}{F}$ $\frac{2}{f_1}$ $\frac{1}{f_m}$

If plane surface is silvered

f_m $\frac{R_2}{2}$ $\frac{\infty}{2}$ ∞

$\therefore \frac{1}{f_1} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$

$= (\mu - 1)\left(\frac{1}{R} - \frac{1}{\infty}\right)$ $\frac{\mu - 1}{R}$

$\therefore \frac{1}{F}$ $\frac{2(\mu-1)}{R}$ $\frac{1}{\infty}$ $\frac{2(\mu-1)}{R}$

$\Rightarrow F$ $\frac{R}{2(\mu-1)}$

Here $R = 20$ cm, μ

$\therefore F$ $\frac{20}{2(1.5-1)}$ 20cm

25. (0.25) Resistors $4\,\Omega$, $6\,\Omega$ and $12\,\Omega$ are connected in parallel, its equivalent resistance (R) is given by

$$\frac{1}{R} \quad \frac{1}{4} \quad \frac{1}{6} \quad \frac{1}{12} \Rightarrow \quad R \quad \frac{12}{6} \quad 2\Omega$$

Again R is connected to 1.5 V battery whose internal resistance $r = 1\ \Omega$.

Equivalent resistance now,

$R' = 2\Omega \ + 1\Omega \ = 3\Omega$

Current, $I_{total} = \frac{V}{R'} \quad \frac{1.5}{3} \quad \frac{1}{2}\text{A}$

$$I_{total} = \frac{1}{2} = 3x + 2x + x = 6x \Rightarrow \quad x = \frac{1}{12}$$

$\therefore$ Current through 4Ω resistor $= 3x$

$$= 3 \times \frac{1}{12} = \frac{1}{4}\text{A}$$

Therefore, rate of Joule heating in the 4Ω resistor

$$= I^2R = \left(\frac{1}{4}\right)^2 \times 4 \quad \frac{1}{4} \quad 0.25\text{W}$$

26. (4) $\text{Stress} = \frac{\text{Normal force}}{\text{Area}} = \frac{N}{A} = \frac{N}{(2\pi a)b}$

Stress = B×strain

$$\frac{N}{(2\pi a)b} = B\frac{2\pi a\Delta a \times b}{\pi a^2 b}$$

$$\Rightarrow N = B\frac{(2\pi a)^2 \Delta a b^2}{\pi a^2 b}$$

Force needed to push the cork.

$f = \mu N = \mu 4\pi b\Delta aB = (4_{\pi\ \mu}\ Bb)_{\Delta}\ a$

27. (40.05) $I_m = \frac{V_m}{R_f \quad R_L} = \frac{25}{(10 \quad 1000)} = 24.75\,\text{mA}$

$$I_{dc} = \frac{I_m}{\pi} = \frac{24.75}{3.14} = 7.87\,\text{mA}$$

$$I_{rms} = \frac{I_m}{2} = \frac{24.75}{2} = 12.37\,\text{mA}$$

$P_{dc} = I_{dc}^2 \times R_L = (7.87 \times 10^{-3})^2 \times 10^3 = 61.9$ mW

$P_{ac} = I_{rms}^2(R_f + R_L) = (12.37 \times 10^{-3})^2 \times (10 + 1000)$

$= 154.54$ mW

Rectifier efficiency

$$\eta = \frac{P_{dc}}{P_{ac}} \times 100 = \frac{61.9}{154.54} \times 100 = 40.05\%$$

28. (5.3) This is a example of uniform circular motion.

$$\omega = \frac{2\pi}{T} \quad 2\pi\ n \quad 2\pi \times \frac{7}{100} \quad 0.44\ \text{rad/sec};$$

$V = R\omega = 0.44 \times 12 = 5.3$ cm/sec.

29. (23) Given, $B = 4 \times 10^{-5}$ T

$R_E = 6.4 \times 10^6$ m

Dipole moment of the earth M = ?

$$B = \frac{\mu_0}{4\pi}\frac{M}{d^3}$$

$$4 \times 10^{-5} \quad \frac{4\pi \times 10^{-7} \times M}{4\pi \times \ 6.4 \times 10^6\ ^3}$$

$\therefore \quad M \equiv 10^{23}\ \text{Am}^2$

30. (2) Total energy, $E = \frac{1}{2}m\omega^2 a^2$;

$$\text{K.E.} = \frac{3E}{4} \quad \frac{1}{2}m\omega^2(a^2 - y^2).$$

So, $\frac{3}{4} \quad \frac{a^2 - y^2}{a^2}$ or $y^2 \quad \frac{a^2}{4}$ or $y \quad \frac{a}{2}$.

CHEMISTRY

31. (1) The order of stability of resonating structures: carrying no charge > carrying minimum charge and each atom having octet complete.

32. (1) Bond order in N_2 and O is 3 (calculated by energy level diagram)

33. (2) In A — O — H, if EN of 'A' is 2.1 then it will be neutral, as $X_A - X_0 = X_0 - X_H$. (where X is EN)

34. (2) Correct order is B < Be < O < N.

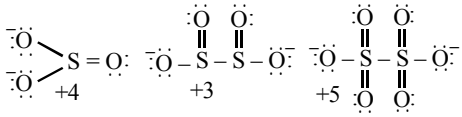
35. (4) In disproportionation reaction, one element of a compound will simultaneously get reduced and oxidised. In ClO_4^-, oxidation number of Cl is +7 and it can not increase it further. So, ClO_4^- will not get oxidised and so will not undergo disporportionation reaction.

36. (3) $K_a \dfrac{[H_3O^+][F^-]}{[HF][H_2O]}$ and

$K_b \dfrac{[HF][OH^-]}{[F^-][H_2O]}$.

Therefore, $K_a \times K_b = [H_3O^+]\,[OH^-] = K_w$.

37. (4) The chemical bond method gives the O.N.



38. (3) As Sb_2S_3 is a negative sol, so $Al_2(SO_4)_3$ will be the most effective coagulant due to higher positive charge on Al (Al^{3+}) – Hardy-Schulze rule.

39. (3) *o*-Nitrophenol is not sufficiently strong acid so as to react with $NaHCO_3$.

40. (3) Because the layer of Al_2O_3 (oxide) is inert, insoluble and impervious.

41. (4) Urotropine is used as antibiotic for urinary tract infection.

42. (4) To convert covalent compounds into ionic compounds such as NaCN, Na_2S, NaX, etc.

43. (4)

$$Zn^{2} + 2NH_4OH \longrightarrow \underset{\text{White ppt.}}{Zn(OH)_2} \quad 2NH_4$$

$$Zn(OH)_2 + 2NH_4OH \longrightarrow \underset{\text{Soluble}}{(NH_4)_2 ZnO_2} \quad 2H_2O$$

$$(NH_4)_2 ZnO_2 + H_2S \longrightarrow \underset{\text{White ppt.}}{ZnS} \quad 2NH_4OH$$

44. (2) $5Fe^{2+} + MnO_4^- + 8H^+ \rightarrow Mn^{2+} + 4H_2O + 5Fe^{3+}$

$5NO_2^- \quad 2MnO_4^- \quad 6H \rightarrow 2Mn^{2+} \quad 5NO_3^- \quad 3H_2O$

45. (3) Formaldehyde can not produce iodoform, as only those compound which contains either $CH_3-\underset{\displaystyle OH}{\underset{|}{CH}}-$ group or $CH_3-\underset{\displaystyle O}{\overset{\|}{C}}-$ group on reaction with potassium iodide and sod. hypochlorite yield iodoform.

46. (1) $2Al + 6HCl \xrightarrow{\Delta,\ air} 2AlCl_3 \quad 3H_2$

$2Al + 3Cl_2 \rightarrow 2AlCl_3$

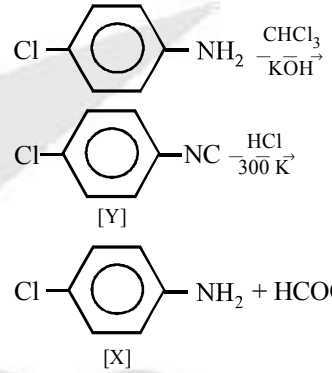
$Al_2O_3 \quad 3C \quad 3Cl_2 \xrightarrow{1000\ C} \underset{\text{vapours}}{2AlCl_3} \quad 3CO$

$\downarrow$ Cooling

Anhydrous $AlCl_3$

$AlCl_3.6H_2O \xrightarrow{\Delta} Al(OH)_3 \quad 3HCl \quad 3H_2O$

Thus $AlCl_3$ cannot be obtained by this method.

47. (1) 

48. (1) Let the rate law be $r = [A]^x[B]^y$

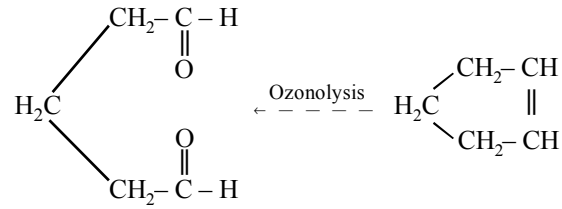
Divide (3) by (1) $\dfrac{0.10}{0.10} \quad \dfrac{[0.024]^x[0.035]^y}{[0.012]^x[0.035]^y}$

$\therefore \ 1 = [2]^x, x = 0$

Divide (2) by (3) $\dfrac{0.80}{0.10} \quad \dfrac{[0.024]^x[0.070]^y}{[0.024]^x[0.035]^y}$

$\therefore \ 8 = (2)^y, y = 3$

Hence rate equation, $R = K[A]^0[B]^3 = K[B]^3$

49. (2) 

50. (3) $2H_2O_2 \xrightarrow{\Delta} 2H_2O \quad O_2$

$2KI + H_2O_2 \rightarrow 2KOH \quad I_2$

$$2KMnO_4 \quad 3H_2SO_4 \quad 5H_2O_2 \longrightarrow$$

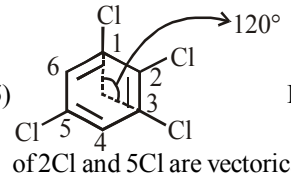
$$K_2SO_4 \quad 2MnSO_4 \quad 8H_2O \quad 5O_2$$

51. (1.24) Energy $= N_A h\nu$

$$495.5 = 6.023 \times 10^{23} \times 6.6 \times 10^{-34} \times \nu$$

$$\nu \quad \frac{495.5 \times 10^3}{6.023 \times 10^{23} \times 6.6 \times 10^{-34}} \quad 12.4 \times 10^{14}$$

$$= 1.24 \times 10^{15} \text{ s}^{-1}.$$

52. (2.25) 

Dipole moments of 2Cl and 5Cl are vectorically cancelled.
It is due 1 Cl and 3 Cl

$$\mu^2 = \mu_1^2 + \mu_2^2 + 2\mu_1\mu_2 \cos\theta$$

$$= (1.5)^2 \quad (1.5)^2 \quad 2 \times 1.5 \times 1.5 \cos 120$$

$$= 2.25 + 2.25 + 4.5 \times -\frac{1}{2}$$

$$= 2.25 + 2.25 - 2.25$$

$$= 2.25 \text{ D}$$

$$\therefore \quad \mu \quad = 2.25 \text{ D}$$

53. (0.5) Moles of H_2SO_4 in 98 mg of H_2SO_4

$$= \frac{1}{98} \times 0.098 \quad 0.001$$

Moles of H_2SO_4 remove

$$= \frac{3.01 \times 10^{20}}{6.02 \times 10^{23}} \quad 0.5 \times 10^{-3} \quad 0.0005$$

Moles of H_2SO_4 left $= 0.001 - 0.0005$

$$= 0.5 \times 10^{-3}$$

54. (1.75) According to Boyle's law

$$\frac{V_1}{V_2} \quad \frac{P_2}{P_1} ; \frac{750}{V_2} \quad \frac{360}{840}$$

$$V_2 = 1750 \text{ mL} = 1.750 \text{ L}$$

55. (5.97) Isoelectric point (pI)

$$= \frac{pK_{a_1} \quad pK_{a_2}}{2} \quad \frac{2.34 \quad 9.60}{2} \quad 5.97$$

56. (400) Let bond energy of A_2 be x then bond energy of AB is also x and bond energy of B_2 is $x/2$.

Enthalpy of formation of AB is – 100 kJ/mol

$$A_2 + B_2 \rightarrow 2AB;$$

$$\frac{1}{2}A_2 + \frac{1}{2}B_2 \rightarrow AB; \Delta_f H = -100 \text{ kJ mol}^{-1}$$

$$\text{or} - 100 \quad \left(\frac{x}{2} \quad \frac{x}{4}\right) - x$$

$$\therefore \quad -100 \quad \frac{2x + x - 4x}{4}$$

$$x = 400 \text{ kJ mol}^{-1}$$

57. (210) Osmotic pressure (π) of isotonic solutions are equal. For solution of unknown substance C_1 (concentration).

$$C_1 \quad \frac{5.25/M}{V}$$

Where M represents molar mass.
For solution of urea, C_2 (concentration)

$$= \frac{1.5/60}{V}$$

Given, $\pi_1 = \pi_2$

$$\because \quad \pi \quad CRT$$

$$\therefore \quad C_1RT = C_2RT \text{ or } C_1 = C_2 \text{ or}$$

$$\frac{5.25/M}{V} \quad \frac{1.5/60}{V}$$

$$\therefore \quad M = 210 \text{ g/mol}$$

58. (0.04) $\Delta G_3 = \Delta G_1 + \Delta G_2$

$$-n_3FE_3 = -n_1FE_1 - n_2FE_2$$

$$E_3 \quad \frac{n_1E_1 \quad n_2E_2}{n_3}$$

$$E_3 \quad \frac{1 \times 0.77 + 2 \quad -0.44}{3}$$

$$\frac{0.77 - 0.88}{3} = -\frac{0.11}{3} \approx -0.04 \text{ V}$$

59. (6) $2MnO_2 \quad 4KOH \quad O_2 \longrightarrow$

$$2K_2MnO_4 \quad 2H_2O$$

Oxidation number of Mn in K_2MnO_4 is 6

K_2MnO_4; $2 + x - 8 = 0$

$$x = +6$$

60. (0.241) Solid AB crystallizes as NaCl structure, so it has coordination number 6 and its r^+/r^- ranges from 0.414 – 0.732.
For maximum radius of anion, we have to take the lower limit of the range 0.414 – 0.732. So, $\frac{r}{r^-} = 0.414$

$$\Rightarrow r^- = \frac{0.100}{0.414}\text{nm} = 0.241\text{ nm}$$

MATHEMATICS

61. (3) $\frac{2}{\cos 2\alpha} \quad \frac{\tan^2\beta \quad 1}{\tan\beta} \quad \frac{1}{\sin\beta \quad \cos\beta}$

$\Rightarrow \sin 2\beta = \cos 2\alpha = \sin(90 - 2\alpha)$

$\Rightarrow \alpha + \beta = \frac{\pi}{4}$

62. (2) $\frac{{}^nC_r}{{}^nC_{r-1}} \quad \frac{r!\,|n}{|r\,.\,|n-r} \cdot \frac{|r-1\,|n-r+1}{|n} \quad \frac{|n-r\quad 1}{|n-r}$

$\frac{|n-r\quad 1}{|n-r} \quad n-r\quad 1$

$\therefore \sum_{r\ 1}^{5} \quad n \quad (n-1) \quad (n-2) \quad (n-3) \quad (n-4)$

$5n-10 \quad 5(n-2)$

63. (2) ${}^{14}C_7 \quad \sum_{i\ 1}^{3} {}^{17-i}C_6$

${}^{14}C_7 \quad {}^{14}C_6 \quad {}^{15}C_6 \quad {}^{16}C_6$

${}^{15}C_7 \quad {}^{15}C_6 \quad {}^{16}C_6$

${}^{16}C_7 \quad {}^{16}C_6 \quad {}^{17}C_7$

64. (2) Given relation is $e^y(x+1) = 1$.
Differentiating both sides w.r.t. x, we get

$(x \quad 1)e^y \frac{dy}{dx} \quad e^y \quad 1 \quad 0$

$\therefore \frac{dy}{dx} = -\frac{1}{x \quad 1}$ ...(i)

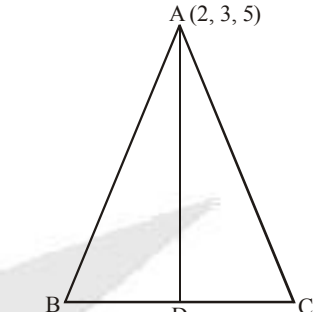
Differentiating again w.r.t. x both sides, we get

$\frac{d}{dx}\left(\frac{dy}{dx}\right) = \frac{d}{dx}\left(-\frac{1}{x \quad 1}\right)$

$\therefore \frac{d^2y}{dx^2} \quad \frac{1}{(x \quad 1)^2}$ ...(ii)

From (i) and (ii), we get $\frac{d^2y}{dx^2} \quad \left(\frac{dy}{dx}\right)^2$.

65. (3) Since AD is the median



$\therefore \quad D \quad \left(\frac{\lambda - 1}{2}, 4, \frac{\mu \quad 2}{2}\right)$

Now, dr's of AD is

$a = \left(\frac{\lambda - 1}{2} - 2\right) \quad \frac{\lambda - 5}{2}$

$b = 4 - 3 = 1, \ c = \frac{\mu + 2}{2} - 5 \quad \frac{\mu - 8}{2}$

Also, a, b, c are dr's

$\therefore \ a = kl, b = km, c = kn$ where $l = m = n$ and $l^2 + m^2 + n^2 = 1$

$\Rightarrow \ l = m = n = \frac{1}{\sqrt{3}}$

Now, $a = 1, b = 1$ and $c = 1$

$\Rightarrow \ \lambda = 7$ and $\mu = 10$

66. (1) $a_1 = 2, b_1 = 2, c_1 = -1$ and $a_2 = 1, b_2 = 2, c_2 = 2$

$\cos\theta \quad \frac{a_1a_2 \quad b_1b_2 \quad c_1c_2}{\sqrt{a_1^2 \quad b_1^2 \quad c_1^2}\sqrt{a_2^2 \quad b_2^2 \quad c_2^2}}$

$\frac{2+4-2}{\sqrt{4 \quad 4 \quad 1}\sqrt{1 \quad 4 \quad 4}} \quad \frac{4}{9}.$

67. (3) Contrapositive of $p \Rightarrow q$ is $\sim q \Rightarrow \sim p$

$\therefore$ contrapositive of $(p \vee q) \Rightarrow r$ is

$\sim r \Rightarrow \sim (p \vee q)$ i.e. $\sim r \Rightarrow (\sim p \wedge \sim q)$

68. (1) Let the co-ordiante of other ends are (x, y, z).
The centre of sphere is C(3, 6, 1)

Therefore, $\frac{x \quad 2}{2} = 3 \Rightarrow x \quad 4$

$\frac{y \quad 3}{2} = 6 \Rightarrow y \quad 9$ and $\frac{z \quad 5}{2} = 1 \Rightarrow z = -3$

69. (1) $I = \int \frac{dx}{(x - \beta)\sqrt{(x - \alpha)(\beta - x)}}$

Put $x = \alpha \sin^2\theta \quad \beta \cos^2\theta$

$dx = 2(\alpha - \beta)\sin\theta \cos\theta \, d\theta$

Also, $(x - \alpha) \quad (\beta - \alpha)\cos^2\theta$

$(x - \beta) \quad (\alpha - \beta)\sin^2\theta$

$\therefore I \quad \int \frac{2(\alpha - \beta)\sin\theta \cos\theta \, d\theta}{(\alpha - \beta)\sin^2\theta (\beta - \alpha)\sin\theta \cos\theta}$

$\frac{2}{\beta - \alpha}\int \frac{d\theta}{\sin^2\theta} \quad \frac{2}{\beta - \alpha}\int \text{cosec}^2\theta \, d\theta$

$\frac{2}{\beta - \alpha}(-\cot\theta) \quad C \quad \frac{2}{\alpha - \beta}\cot\theta \quad C$

Now, $x = \alpha \sin^2\theta \quad \beta \cos^2\theta$

$\Rightarrow x\text{cosec}^2\theta = \alpha + \beta \cot^2\theta$

$\Rightarrow x(1 \quad \cot^2\theta) \quad \alpha \quad \beta \cot^2\theta$

$\therefore \cot\theta \quad \sqrt{\frac{x - \alpha}{\beta - x}}$;

$\therefore I \quad \frac{2}{\alpha - \beta}\sqrt{\frac{x - \alpha}{\beta - x}} \quad C$

70. (4) Given planes are
$P: x + y - 2z + 7 = 0$
$Q: x + y + 2z + 2 = 0$
and $R: 3x + 3y - 6z - 11 = 0$
Consider Plane P and R.
Here $a_1 = 1, b_1 = 1, c_1 = -2$
and $a_2 = 3, b_2 = 3, c_2 = -6$
Since, $\frac{a_1}{a_2} \quad \frac{b_1}{b_2} \quad \frac{c_1}{c_2} \quad \frac{1}{3}$
therefore P and R are parallel.

71. (1) $\frac{1}{1^4} \quad \frac{1}{2^4} \quad \frac{1}{3^4} \quad \frac{1}{4^4} \quad \ldots\infty \quad \frac{\pi^4}{90}$

$\frac{1}{1^4} \quad \frac{1}{3^4} \quad \frac{1}{5^4} \quad \ldots \quad \infty \quad \frac{1}{2^4}\left(\frac{1}{1^4} \quad \frac{1}{2^4} \quad \frac{1}{3^4} \quad \frac{1}{4^4} \quad \ldots\infty\right)$

$\frac{\pi^4}{90}$

$\frac{1}{1^4} \quad \frac{1}{3^4} \quad \frac{1}{5^4} \quad \frac{1}{7^4} \quad \ldots \quad \infty + \frac{1}{16} \times \frac{\pi^4}{90} \quad \frac{\pi^4}{90}$

$\therefore \frac{1}{1^4} \quad \frac{1}{3^4} \quad \frac{1}{5^4} \quad \frac{1}{7^4} \quad \ldots \quad \infty \quad \frac{\pi^4}{90} - \frac{1}{16}\left(\frac{\pi^4}{90}\right)$

$\frac{15}{16}\left(\frac{\pi^4}{90}\right) \quad \frac{\pi^4}{96}$.

72. (2) We have, $f(x) = \exp \sqrt{5x - 3 - 2x^2}$

i.e., $f(x) = e^{\sqrt{5x-3-2x^2}}$

For domain of $f(x)$, $5x - 3 - 2x^2$ should be +ve.

i.e., $5x - 3 - 2x^2 \geq 0$

$\Rightarrow 2x^2 - 5x + 3 \leq 0$

(By taking –ve sign common)

$\Rightarrow 2x(x-1) - 3(x-1) \leq 0$

$\Rightarrow (2x-3)(x-1) \leq 0$

$\Rightarrow 2x - 3 \leq 0$ or $x - 1 \geq 0$

$\Rightarrow x \leq \frac{3}{2}$ or $x \geq 1$

$\therefore 1 \leq x \leq \frac{3}{2}$ i.e., $x \in \left[1, \frac{3}{2}\right]$

Hence, domain of the given function is $\left[1, \frac{3}{2}\right]$.

73. (1) Given determinant

$$\begin{vmatrix} 1 & a & a^2 \\ \cos(n-1)x & \cos nx & \cos(n \quad 1)x \\ \sin(n-1)x & \sin nx & \sin(n \quad 1)x \end{vmatrix} = 0$$

$$\Rightarrow \begin{vmatrix} 1 + a^2 - 2a\cos x & a & a^2 \\ 0 & \cos nx & \cos(n \quad 1)x \\ 0 & \sin nx & \sin(n \quad 1)x \end{vmatrix} = 0$$

By applying $C_1 \rightarrow C_1 + C_3 - 2\cos x \, C_2$

By expanding

$(1 + a^2 - 2a\cos x)[\cos nx \sin(n+1)x - \sin nx \cos(n+1)x] = 0$

Now, $(1 + a^2 - 2a\cos x)\sin(n+1-n)x = 0$

$\Rightarrow (1 + a^2 - 2a\cos x)\sin x \quad 0$

$\sin x = 0$ or $\cos x = \dfrac{1 \quad a^2}{2a}$

As $a \neq 1$ $\therefore \left(\dfrac{1 \quad a^2}{2a}\right) \quad 1$

$\Rightarrow \cos x \quad 1$ It is not possible.

$\therefore \sin x = 0$

74. (4) We have, $a = \cos\left(\dfrac{2\pi}{7}\right) \quad i\sin\left(\dfrac{2\pi}{7}\right)$

$\Rightarrow a^7 = \left[\cos\left(\dfrac{2\pi}{7}\right) \quad i\sin\left(\dfrac{2\pi}{7}\right)\right]^7$

$= \cos 2\pi + i\sin 2\pi = 1$ ...(i)

Let $S = \alpha + \beta = (a + a^2 + a^4) + (a^3 + a^5 + a^6)$

$[\because \alpha = a + a^2 + a^4, \beta = a^3 + a^5 + a^6]$

$\Rightarrow S = a + a^2 + a^3 + a^4 + a^5 + a^6$

$= \dfrac{a(1-a^6)}{1-a}$

$\Rightarrow S = \dfrac{a-a^7}{1-a} \quad \dfrac{a-1}{1-a} = -1$ ...(ii)

Let $P = \alpha\beta = (a + a^2 + a^4)(a^3 + a^5 + a^6)$

$= a^4 + a^6 + a^7 + a^5 + a^7 + a^8 + a^7 + a^9 + a^{10}$

$= a^4 + a^6 + 1 + a^5 + 1 + a + 1 + a^2 + a^3$

[from Eq. (i)]

$= 3 + (a + a^2 + a^3 + a^4 + a^5 + a^6) = 3 + S$

$= 3 - 1 = 2$ [from Eqn. (ii)]

Required equation is, $x^2 - Sx + P = 0$

$\Rightarrow x^2 + x + 2 = 0$

75. (1) We have,

$$AB \begin{bmatrix} \cos^2\theta & \cos\theta\sin\theta \\ \cos\theta\sin\theta & \sin^2\theta \end{bmatrix} \begin{bmatrix} \cos^2\phi & \cos\phi\sin\phi \\ \cos\phi\sin\phi & \sin^2\phi \end{bmatrix}$$

$$\begin{bmatrix} \cos^2\theta\cos^2\phi & \cos\theta\cos\phi\sin\theta\sin\phi \\ \cos\theta\sin\theta\cos^2\phi & \sin^2\theta\cos\phi\sin\phi \end{bmatrix}$$

$$\begin{bmatrix} \cos^2\theta\cos\phi\sin\phi & \cos\theta\sin\theta\sin^2\phi \\ \cos\theta\cos\phi\sin\theta\sin\phi & \sin^2\theta\sin^2\phi \end{bmatrix}$$

$$\cos(\theta - \phi)\begin{bmatrix} \cos\theta\cos\phi & \cos\theta\sin\phi \\ \sin\theta\cos\phi & \sin\theta\sin\phi \end{bmatrix}$$

Since, $AB = 0$, $\therefore \cos(\theta - \phi) \quad 0$

$\therefore \theta - \phi$ is an odd multiple of $\dfrac{\pi}{2}$

76. (3) $f\ x = xe^{x\ 1-x}, x \in R$

$f'\ x \quad e^{x\ 1-x}.\left[1 \quad x - 2x^2\right]$

$= -e^{x\ 1-x}.\left[2x^2 - x - 1\right]$

$= -2e^{x\ 1-x}.\left[\left(x + \dfrac{1}{2}\right)\ x - 1\right]$

$f'\ x = -2e^{x\ 1-x}.A$

where $A = \left(x + \dfrac{1}{2}\right)\ x - 1$

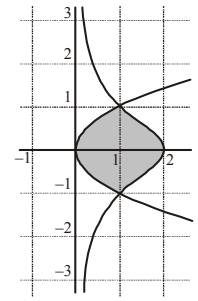
Now, exponential function is always +ve and $f'(x)$ will be opposite to the sign of A which is –ve in $\left[-\dfrac{1}{2}, 1\right]$

Hence, $f'(x)$ is +ve in $\left[-\dfrac{1}{2}, 1\right]$

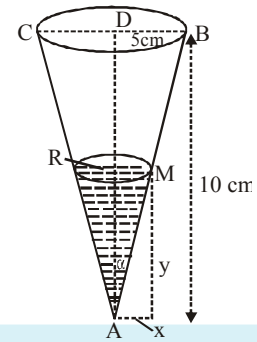
$\therefore f(x)$ is increasing on $\left[-\dfrac{1}{2}, 1\right]$

77. (1) Solving curves, we get point of intersections $(1, \pm 1)$. Required area

$= 2\int_0^1 \left(\dfrac{2}{1 \quad y^2} - y^2\right) dy = \pi - \dfrac{2}{3}$.



78. (4) Let y be the level of water at time t and x the radius of the surface and V, the volume of water.



We know that the volume of cone

$\frac{1}{3}\pi$ (radius)$^2 \times$ height

$\therefore$ V $\frac{1}{3}\pi x^2 y$. Let $\angle$ BAD α

$\Rightarrow$ $\tan\alpha$ $\frac{BD}{AD}$ $\frac{5}{10}$ $\frac{1}{2}$.

Again, from right angled Δ AMR, we have

$\tan\alpha$ $\frac{MR}{AR}$ $\frac{x}{y}$; $\Rightarrow$ $\frac{1}{2}$ $\frac{x}{y}$; $\therefore$ x $\frac{y}{2}$.

$$\therefore V=\frac{1}{3}\pi x^2 y=\frac{1}{3}\pi\left(\frac{y}{2}\right)^2.y \quad \frac{\pi}{12}y^3 \qquad \text{.....(1).}$$

By question, the rate of change of volume

$= \frac{dV}{dt}$ 4 cub.cm./min.

We have to find out the rate of increase of water-level i.e. $\frac{dy}{dt}$.

Differentiating (1) with respect to t, we get

$\frac{dV}{dt}$ $\frac{\pi}{12}.3y^2.\frac{dy}{dt}$; $\therefore$ 4 $\frac{\pi}{4}y^2.\frac{dy}{dt}$; $\therefore$ $\frac{dy}{dt}$ $\frac{16}{\pi y^2}$.

When y = 6 cm,

$\frac{dy}{dt}$ $\frac{16}{\pi 6^2}$ $\frac{4}{9\pi}$ cub.cm./min.

79. (4) Slope of the tangent to $4x^2 - 9y^2 = 36$ is given by

$8x - 18y\frac{dy}{dx}$ $0 \Rightarrow$ $\frac{dy}{dx}$ $\frac{4x}{9y}$ or $m_1 = \frac{4x}{9y}$

Slope of the straight line, $5x + 2y - 10 = 0$ is

$m_2 = -\frac{5}{2}$

Therefore, for the perpendicularity, $m_1 m_2 = -1$

Now, $\frac{4x}{9y} \times \frac{-5}{2}$ $-1 \Rightarrow$ y $\frac{10x}{9}$.

Putting y $\frac{10x}{9}$ in $4x^2 - 9y^2$ 36

gives imaginary roots resulting in no tangents.

80. (1) I $\int_{\log\sqrt{\pi}/2}^{\log\sqrt{\pi}} e^{2x}\sec^2\left(\frac{1}{3}e^{2x}\right)dx$

Put e^{2x} $t \Rightarrow 2e^{2x}dx$ dt

When $x = \log\sqrt{\pi/2}$, t $e^{2\log\sqrt{\pi/2}}$

$= e^{\log\pi/2}$ $\frac{\pi}{2}$

When $x = \log\sqrt{\pi}$, $t = e^{2\log\sqrt{\pi}}$ π

$\therefore$ I $\int_{\frac{\pi}{2}}^{\pi}\frac{1}{2}\sec^2\left(\frac{1}{3}t\right)dt$

$\frac{1}{2}.\frac{1}{\frac{1}{3}}\left[\tan\frac{t}{3}\right]_{\pi/2}^{\pi}$

$\frac{3}{2}\left[\tan\frac{\pi}{3} - \tan\frac{\pi}{6}\right]$

$\frac{3}{2}\left[\sqrt{3} - \frac{1}{\sqrt{3}}\right]$ $\sqrt{3}$

81. (0) If the G.P be $a, ar, ar^2, \ldots$ then $a_n = ar^{n-1}$

$$D=\begin{vmatrix} \log a+(n-1)\log r & \log a & n\log r & \log a & (n-1)\log r \\ \log a & n\log r & \log a & (n-1)\log r & \log a & (n-2)\log r \\ \log a & (n-1)\log r & \log a & (n-2)\log r & \log a & (n-3)\log r \end{vmatrix}$$

$R_3 \to R_3 - R_2$ and $R_2 \to R_2 - R_1$ gives,

$$=\begin{vmatrix} \log a+(n-1)\log r & \log a & n\log r & \log a & (n-1)\log r \\ \log r & \log r & \log r \\ \log r & \log r & \log r \end{vmatrix}$$

= 0, since R_2 and R_3 are identical.

82. (0.80) Total no. of arrangements of the letters of the word UNIVERSITY is $\frac{10!}{2!}$.

No. of arrangements when both I's are together = 9!

So. the no. of ways in which 2 I's do not together = $\frac{10!}{2!} - 9!$

$\therefore$ Required probability

$= \frac{\frac{10!}{2!} - 9!}{\frac{10!}{2!}}$ $\frac{10! - 9!\,2!}{10!}$

$\frac{10\times 9! - 9!.2!}{10!}$ $\frac{9![10-2]}{10\times 9!}$

$\frac{8}{10}$ $\frac{4}{5} = 0.80$

83. (0.25) $n(S)$ = the area of the circle of radius r

$n(E)$ = the area of the circle of radius $\frac{r}{2}$

$\therefore$ The probability $\frac{n(E)}{n(S)} = \frac{\pi\left(\frac{r}{2}\right)^2}{\pi r^2} = \frac{1}{4}$.

84. (0.33) $P(\bar{E}E) \quad P(\bar{E}\bar{E}\bar{E}\bar{E}E) \quad \ldots\infty$

$$= \frac{5}{6}\times\frac{1}{6} + \left(\frac{5}{6}\right)^4 \times\frac{1}{6} \quad \left(\frac{5}{6}\right)^8 \frac{1}{6} \quad \ldots\infty$$

$$\frac{5}{36}\left[1 \quad \left(\frac{5}{6}\right)^3 \quad \ldots\ldots\infty\right] \quad \frac{30}{91}$$

85. (7.00) Given equation of ellipse is

$$\frac{x^2}{16} \quad \frac{y^2}{b^2} \quad 1$$

$$\text{eccentricity} = e = \sqrt{1-\frac{b^2}{16}}$$

$$\text{foci:} \quad ae \quad 4\sqrt{1-\frac{b^2}{16}}$$

Equation of hyperbola is $\frac{x^2}{144} - \frac{y^2}{81} \quad \frac{1}{25}$

$$\Rightarrow \quad \frac{x^2}{\frac{144}{25}} - \frac{y^2}{\frac{81}{25}} \quad 1$$

$$\text{Eccentricity} = e \quad \sqrt{1 \quad \frac{81}{25}\times\frac{25}{144}} \quad \sqrt{1 \quad \frac{81}{144}}$$

$$= \sqrt{\frac{225}{144}} \quad \frac{15}{12}$$

$$\text{foci:} \quad ae \quad \frac{12}{5}\times\frac{15}{12} \quad 3$$

Since, foci of ellipse and hyperbola coincide

$$\therefore \quad \pm 4\sqrt{1-\frac{b^2}{16}} \quad 3 \Rightarrow b^2 \quad 7$$

86. (1.00) For $x > 10$, $f(x) = x - 2$.
Therefore, $g(x) = x - 2 - 2 = x - 4$
$\therefore$ $g'(x) = 1$.

87. (3.00) $\because$ A.M. $\geq$ G.M. $\Rightarrow$ $\frac{a \quad b \quad c}{3} \geq (abc)^{1/3}$

$\Rightarrow \quad a + b + c \geq 3(abc)^{1/3} \qquad (1)$

But given : ab^2c^3, $a^2b^3c^4$, $a^3b^4c^5$ are also in AP.
$(\because abc \neq 0)$

$\Rightarrow \quad 2abc = 1 + a^2b^2c^2 \quad \Rightarrow \quad (abc-1)^2 = 0$

$\therefore \quad abc = 1$

Now from equation (1), $a + b + c \geq 3(1)^{1/3}$

$\Rightarrow \quad (a + b + c) \geq 3$

Hence, minimum value of is $a + b + c$ is 3.

88. (1.50) Sum of coefficients is obtained by simply putting x = 1 in the expression

So, sum of coefficients $= \left(\frac{2}{3}\right)^{199} \times \left(\frac{3}{2}\right)^{200}$

$$= \left(\frac{3}{2}\right)^{-199} \times \left(\frac{3}{2}\right)^{200} \quad \frac{3^{200-199}}{2^{200-199}} \quad \frac{3}{2} = 1.50$$

89. (14.00) Since $0 < y < x < 2y$

$$\therefore \quad y \quad \frac{x}{2} \quad \Rightarrow \quad x - y \quad \frac{x}{2}$$

$$\therefore \quad x - y < y < x < 2x + y$$

$$\text{Hence median} = \frac{y \quad x}{2} \quad 10$$

$$\Rightarrow \quad x + y = 20 \qquad \ldots(i)$$

And range $= (2x + y) - (x - y) = x + 2y$

But range $= 28$

$$\therefore \quad x + 2y = 28 \qquad \ldots(ii)$$

From equations (i) and (ii),

$x = 12, y = 8$

$\therefore$ Mean

$$= \frac{(x - y) \quad y \quad x \quad (2x \quad y)}{4} \quad \frac{4x \quad y}{4}$$

$$= x \quad \frac{y}{4} \quad 12 \quad \frac{8}{4} \quad 14$$

90. (3.20) $\int \frac{dx}{\cos^3 x\sqrt{4\sin x\cos x}}$

$$= \int \frac{dx}{2\cos^4 x\sqrt{\tan x}}$$

Let $\tan x = t^2 \Rightarrow \sec^2 x = 1 + t^4$

$\sec^2 x\, dx = 2t\, dt$

$$= \int \frac{\sec^4 x\, dx}{2\sqrt{\tan x}} = \int \frac{\sec^2 x(\sec^2 x\, dx)}{2\sqrt{\tan x}}$$

$$= \int \frac{(1 \quad t^4)2t\ dt}{2t} = \int (1 \quad t^4)\ dt$$

$$= t \quad \frac{t^5}{5} \quad k$$

$$= \sqrt{\tan x} \quad \frac{1}{5}\tan^{5/2} x \quad k\left[t \quad \sqrt{\tan x}\right]$$

$$A = \frac{1}{2}, B = \frac{5}{2}, C = \frac{1}{5}$$

$$A + B + C = \frac{16}{5} = 3.20$$