PHYSICS

1. **The mean energy per molecule for a diatomic gas is**

   (a)$\frac{5k_BT}{N}$ (b)$\frac{5k_BT}{2N}$

   (c)$\frac{5k_BT}{2}$ (d)$\frac{3k_BT}{2}$

2. **The phase difference between displacement and velocity of a particle in simple harmonic motion is**

   (a)πrad (b)$3\pi/2$rad

   (c)zero (d)$\pi/2$rad

3. **The mass density of a nucleus varies with mass number A as**

   (a)$\overset{o}{A}$ (b)A^2

   (c)$\frac{1}{A}$ (d)ln A

4. **A capacitor of capacity 2μ F is charged upto a potential 14 V and then connected in parallel to an uncharged capacitor of capacity 5μ F. The final potential difference across each capacitor will be**

   (a)6 V (b)4 V

   (c)8 V (d)14 V

5. **The ratio of amplitude of magnetic field to the amplitude of electric field of an electromagnetic wave propagating in vacuum is**

   (a)reciprocal of speed of light in vacuum

   (b)the speed of light in vacuum

   (c)proportional to frequency of the electromagnetic wave

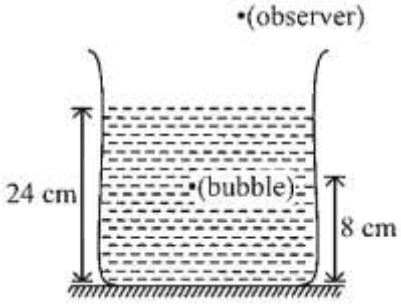
   (d)inversely proportional to the frequency of the electromagnetic wave

6. **A particle is projected at an angle 30° with horizontal having kinetic energy K. The kinetic energy of the particle at highest point is.**

   (a)$\frac{1}{2}$K (b)$\frac{3}{4}$K

   (c)$\frac{3}{8}$K (d)$\frac{5}{8}$K

7. **An air bubble in water ($\mu = \frac{4}{3}$) is shown in figure. The apparent depth of the image of the bubble in plane mirror viewed by observer is.**



   (a)16 cm (b)18 cm

   (c)24 cm (d)12 cm

8. **A transistor is connected in CE configuration. The collector supply is 10 V and the voltage drop across a resistor of 1000Ω in the collector circuit is 0.5 V . If the current gain factor is 0.96 , then the base current is**

   (a)25_6μA (b)20.8μA

   (c)22.5μA (d)15μA

9. **One end of the string of length l is connected to a particle of mass m and the other end is connected to a small peg on a smooth horizontal table. If the particle moves in circle with speed v, the net force on the particle (directed towards centre) will be (T represents the tension in the string)**

   (a)T (b)$T + \frac{mv^2}{l}$

   (c)$T - \frac{mv^2}{l}$ (d)zero

10. **A thin circular ring of mass, M and radius R rotates about an axis through its centre and perpendicular to its plane, with a constant angular velocity ω. Four small spheres each of mass m (negligible radius) are kept**

gently to the opposite ends of two mutually perpendicular diameters of the ring. The new angular velocity of the ring will be

(a)$\left(\frac{M+4m}{M}\right)\omega$ (b)$\frac{M}{4m}\omega$

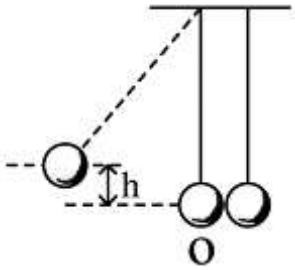
(c)$\left(\frac{M}{M+4m}\right)\omega$ (d)$\left(\frac{M}{M-4m}\right)\omega$

11. Two wire of same material having radius in ratio 2: 1 and lengths in ratio 1: 2. If same force is applied on them, then ratio of their change in length will be

(a)1: 1 (b)1: 2

(c)1: 4 (d)1: 8

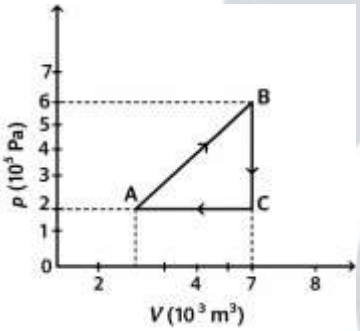
12. In the figure, pendulum bob on left side is pulled a side to a height h from its initial position. After it is released it collides with the right pendulum bob at rest, which is of same mass. After the collision, the two bobs stick together and rise to a height



(a) $\frac{3h}{4}$ (b) $\frac{2h}{3}$

(c) $\frac{h}{2}$ (d) $\frac{h}{4}$

13. A gas is taken through the cycle A → B → C → A, as shown in figure. What is the net work done by the gas?



(a)2000 J (b)1000 J

(c)Zero (d)-2000 J

14. The gases carbon monoxide (CO) and nitrogen at the same temperature have kinetic energies E_1 and E_2, respectively. Then,

(a)$E_1 = E_2$ (b)$E_1 > E_2$

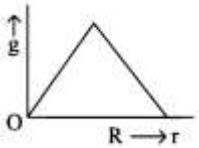
(c)$E_1 < E_2$ (d)None of these

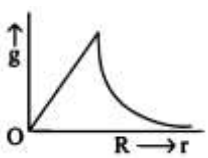
15. Two wires are made of the same material and have the same volume. The first wire has cross-sectional area A and the second wire has cross-sectional are 3A. If the length of the first wire is increased by Δl on applying a force F, how much force is needed to stretch the second wire by the same amount?

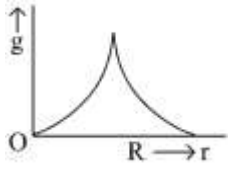
(a)4 F (b)6 F

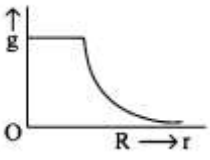
(c)9 F (d)F

16. Starting from the centre of the earth having radius R, the variation of g (acceleration due to gravity) is shown by

(a) 

(b) 

(c) 

(d) 

17. A long spring, when stretched by a distance x, has potential energy U. On increasing the stretching to nx, the potential energy of the spring will be

(a)$\frac{U}{n}$ (b)nU

(c)n^2U (d)$\frac{U}{n^2}$

18. With what velocity should an observer approach a stationary sound source, so that the apparent frequency of sound should appear double the actual frequency?

(a)v/2 (b)3v

(c)2v (d)v

19. A dielectric of dielectric constant K is introduced such that half of its area of a capacitor of capacitance C is occupied by it. The new capacity is

(a)2C (b)$\frac{C}{2}$

(c)$\frac{(1+K)C}{2}$ (d)$2C(1+K)$

20. Two very long straight parallel wires carry currents i and 2i in opposite directions. The distance between the wires is r. At a certain instant of time a point charge q is at. a point equidistant from the two wires in the plane of the wires. Its instantaneous velocity v is perpendicular to this plane. The magnitude of the force due to the magnetic field acting on the charge at this instant is

(a)zero (b)$\frac{3\mu_0}{2\pi}\frac{iqv}{r}$

(c)$\frac{\mu_0}{\pi}\frac{iqv}{r}$ (d)$\frac{\mu_0}{2\pi}\frac{iqv}{r}$

21. The magnetic flux linked with a coil satisfies the relation $\phi = (4t^2 + 6t + 9)$Wb, where t is time in second. The emf induced in the coil at $t = 2$ s is

(a)22 V (b)18 V

(c)16 V (d)40 V

22. The instantaneous values of alternating current and voltages in a circuit given as $i = \frac{1}{\sqrt{2}}\sin(100\pi t)$amp,$e = \frac{1}{\sqrt{2}}\sin(100\pi t + \pi/3)$ volt.

The average power (in watts) consumed in the circuit is

(a)$\frac{1}{4}$ (b)$\frac{\sqrt{3}}{4}$

(c)$\frac{1}{2}$ (d)$\frac{1}{8}$

23. A car is moving towards a high cliff. The car driver sounds a horn of frequency f. The reflected sound heard by the driver has a frequency 2f. If v be the velocity of sound, then the velocity of the car in the same velocity units, will be

(a)$\frac{v}{\sqrt{2}}$ (b)$\frac{v}{3}$

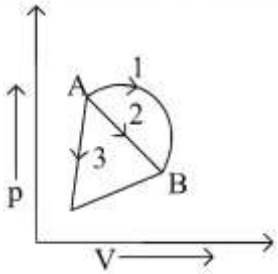
(c)$\frac{v}{4}$ (d)$\frac{v}{2}$

24. If escape velocity on earth surface is 11.1kmh^{-1}, then find the escape velocity on moon surface. If mass of moon is $\frac{1}{81}$ times of mass of earth and radius of moon is $\frac{1}{4}$ times radius of earth.

(a)2.46kmh^{-1} (b)3.46kmh^{-1}

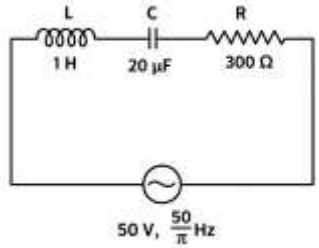
(c)4.4kmh^{-1} (d)None of these

25. An ideal gas goes from state A to state B via three different processes as indicated in the $p - V$ diagram. If Q_1, Q_2 and Q_3 indicate the heat absorbed by the three processes and $\Delta U_1, \Delta U_2$ and ΔU_3 indicate the change in internal energy along the three processes respectively, then



(a)$Q_1 > Q_2 > Q_3$ and $\Delta U_1 = \Delta U_2 = \Delta U_3$
(b)$Q_3 > Q_2 > Q_1$ and $\Delta U_1 = \Delta U_2 = \Delta U_3$
(c)$Q_1 = Q_2 = Q_3$ and $\Delta U_1 > \Delta U_2 > \Delta U_3$
(d)$Q_3 > Q_2 > Q_1$ and $\Delta U_1 > \Delta U_2 > \Delta U_3$

26. In the series L − C-R circuit shown, the impedance is



(a)200Ω (b)100Ω
(c)300Ω (d)500Ω

27. In Young's double slit interference experiment, using two coherent waves of different amplitudes, the intensities ratio between bright and dark fringes is 3 . Then, the value of the ratio of the amplitudes of the wave that arrive there is

(a)$\left(\frac{\sqrt{3}+1}{\sqrt{3}-1}\right)$ (b)$\left(\frac{\sqrt{3}-1}{\sqrt{3}+1}\right)$
(c)$\sqrt{3}:1$ (d)$1:\sqrt{3}$

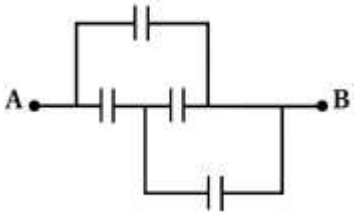
28. The wavelength of the first line of Lyman series for H - atom is equal to that of the second line of Balmer series for a H-like ion. The atomic number Z of H-like ion is

(a)4 (b)1
(c)2 (d)3

29. If 150 J of heat is added to a system and the work done by the system is 110 J , then change in internal energy will be

(a)40 J (b)110 J
(c)150 J (d)260 J

30. In the figure below, the capacitance of each capacitor is 3μ F. The effective capacitance between A and B is



(a)$\frac{3}{4}$ μ F (b)3μ F
(c)6μ F (d)5μ F

31. The first emission of hydrogen atomic spectrum in Lyman series appears at a wavelength of

(a)$\frac{3R}{4}$ cm^{-1} (b)$\frac{4}{3R}$ cm
(c)$\frac{7R}{144}$ cm^{-1} (d)$\frac{400}{9R}$ cm

32. In Young's double slit experiment, the ratio of maximum and minimum intensities in the fringe system is 9: 1. The ratio of amplitudes of coherent sources is

(a)9: 1 (b)3: 1
(c)2: 1 (d)1: 1

33. In the case of an inductor

(a)voltage lags the current by $\pi/2$

(b)voltage leads the current by $\pi/2$

(c)voltage leads the current by $\pi/3$

(d)voltage leads the current by $\pi/4$

34. The height vertically above the earth's surface at which the acceleration due to gravity becomes 1% of its value at the surface is

(a)8R (b)9R

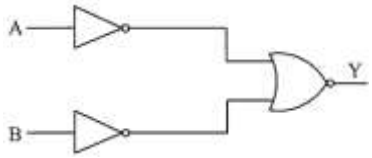
(c)10R (d)20R

35. If C be the capacitance and V be the electric potential, then the dimensional formula of CV^2 is

(a)$[ML^2\ T^{-2}\ A^0]$ (b)$[MLT^{-2}\ A^{-1}]$

(c)$[M^0LT^{-2}\ A^0]$ (d)$[ML^{-3}TA]$

36. Which logic gate is represented by the following combination logic gates?



(a)OR (b)NAND

(c)AND (d)NOR

37. An LED is constructed from a $p-n$ junction diode using GaAsP. The energy gap is 1.9 eV . The wavelength of the light emitted will be equal to

(a)10.4×10^{-26}m (b)654 nm

(c)654Å (d)654×10^{-11}m

38. A body is projected vertically upwards. The times corresponding to height h while ascending and while descending are t_1 and t_2, respectively. Then, the velocity of projection will be (take, g as acceleration due to gravity)

(a)$\frac{g\sqrt{t_1t_2}}{2}$ (b)$\frac{g(t_1+t_2)}{2}$

(c)$g\sqrt{t_1t_2}$ (d)$g\frac{t_1t_2}{(t_1+t_2)}$

39. When a certain metal surface is illuminated with light of frequency ν, the stopping potential for photoelectric current is V_0. When the same surface is illuminated by light of frequency $\frac{\nu}{2}$, the stopping potential is $\frac{V_0}{4}$. The threshold frequency for photoelectric emission is

(a)$\frac{\nu}{6}$ (b)$\frac{\nu}{3}$

(c)$\frac{2\nu}{3}$ (d)$\frac{4\nu}{3}$

40. A fish in water (refractive index n) looks at a bird vertically above in the air. If y is the height of the bird and x is the depth of the fish from the surface, then the distance of the bird as estimated by the fish is

(a)$x+y\left(1-\frac{1}{n}\right)$ (b)$x+ny$

(c)$x+y\left(1+\frac{1}{n}\right)$ (d)$y+x\left(1-\frac{1}{n}\right)$

41. A car starts from rest and accelerates uniformly to a speed of 180kmh^{-1} in 10 s . The distance covered by the car in this time interval is

(a)500 m (b)250 m

(c)100 m (d)200 m

42. A plane electromagnetic wave of frequency 20 MHz travels through a space along x-direction. If the electric field vector at a certain point in space is 6Vm^{-1}, then what is the magnetic field vector at that point?

(a)2×10^{-8} T (b)$\frac{1}{2}\times10^{-8}$ T

(c)2 T (d)$\frac{1}{2}$ T

43. The sides of a parallelogram are represented by vectors $\vec{p} = 5\hat{i} - 4\hat{j} + 3\hat{k}$ and $\vec{q} = 3\hat{i} + 2\hat{j} - \hat{k}$. Then, the area of the parallelogram is

(a)$\sqrt{684}$ sq units (b)$\sqrt{72}$ sq units
(c)171 sq units (d)72 sq units

44. If θ_1 and θ_2 be the apparent angles of dip observed in two vertical planes at right angles to each other, then the true angle of dipθ is given by

(a)$\cot^2\theta = \cot^2\theta_1 + \cot^2\theta_2$
(b)$\tan^2\theta = \tan^2\theta_1 + \tan^2\theta_2$
(c)$\cot^2\theta = \cot^2\theta_1 - \cot^2\theta_2$
(d)$\tan^2\theta = \tan^2\theta_1 - \tan^2\theta_2$

45. Let K_1 be the maximum kinetic energy of photoelectrons emitted by light of wavelength λ_1 and K_2 corresponding to wavelength λ_2. If $\lambda_1 = 2\lambda_2$, then

(a)$2K_1 = K_2$ (b)$K_1 = 2K_2$
(c)$K_1 < K_2/2$ (d)$K_1 > 2K_2$

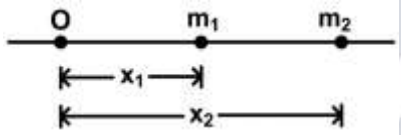
46. A ball is projected horizontally with a velocity of 5 ms^{-1} from the top of a building 19.6 m high. How long will the ball take to hit the ground?

(a)$\sqrt{2}$ s (b)2 s
(c)$\sqrt{3}$ s (d)3 s

47. A galvanometer having a resistance of 8Ω is shunted by a wire of resistance 2Ω. If the total current is 1 A , the part of it passing through the shunt will be

(a)0.25 A (b)0.8 A
(c)0.2 A (d)0.5 A

48. In the diagram shown below, m_1 and m_2 are the masses of two particles and x_1 and x_2 are their respective distances from the origin O.



The centre of mass of the system is

(a)$\frac{m_1x_2+m_2x_2}{m_1+m_2}$ (b)$\frac{m_1+m_2}{2}$
(c)$\frac{m_1x_1+m_2x_2}{m_1+m_2}$ (d)$\frac{m_1m_2+x_1x_2}{m_1+m_2}$

49. A block of wood floats in water with $(4/5)$ th of its volume submerged. If the same block just floats in a liquid, the density of the liquid is (in kgm^{-3})

(a)1250 (b)600
(c)400 (d)800

50. A balloon with mass m is descending down with an acceleration a (where, $a < g$). How much mass should be removed from it so that it starts moving up with an acceleration a ?

(a)$\frac{2ma}{g+a}$ (b)$\frac{2ma}{g-a}$
(c)$\frac{ma}{g+a}$ (d)$\frac{ma}{g-a}$

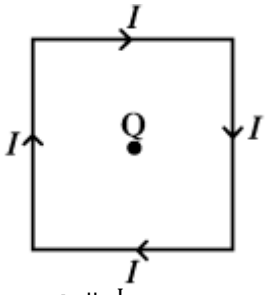
51. A straight wire of length 2 m carries a current of 10 A . If this wire is placed in uniform magnetic field of 0.15 T making an angle of 45° with the magnetic field, the applied force on the wire will be

(a)1.5 N (b)3 N
(c)$3\sqrt{2}$ N (d)$3/\sqrt{2}$ N

52. Two slabs are of the thicknesses d_1 and d_2. Their thermal conductivities are K_1 and K_2, respectively. They are in series. The free ends of the combination of these two slabs are kept at temperatures θ_1 and θ_2. Assume $\theta_1 > \theta_2$. The temperature θ of their common junction is

(a)$\frac{K_1\theta_1+K_2\theta_2}{\theta_1+\theta_2}$ (b)$\frac{K_1\theta_1d_1+K_2\theta_2d_2}{K_1d_2+K_2d_1}$
(c)$\frac{K_1\theta_1d_2+K_2\theta_2d_1}{K_1d_2+K_2d_1}$ (d)$\frac{K_1\theta_1+K_2\theta_2}{K_1+K_2}$

53. A square wire of each side 1 carries a current I. The magnetic field at the mid-point of the square



(a) $4\sqrt{2}\frac{\mu_0}{4\pi}\frac{I}{l}$ (b) $8\sqrt{2}\frac{\mu_0}{4\pi}\frac{I}{l}$
(c) $16\sqrt{2}\frac{\mu_0}{4\pi}\frac{I}{l}$ (d) $32\sqrt{2}\frac{\mu_0}{4\pi}\frac{I}{l}$

54. A cylinder of radius r and of thermal conductivity K_1 is surrounded by a cylindrical shell of inner radius r and outer radius 2r made of a material of thermal conductivity K_2. The effective thermal conductivity of the system is

(a) $\frac{1}{3}(K_1 + 2K_2)$ (b) $\frac{1}{2}(2K_1 + 3K_2)$
(c) $\frac{1}{3}(3K_2 + 2K_1)$ (d) $\frac{1}{4}(K_1 + 3K_2)$

55. The speeds of air-flow on the upper and lower surfaces of a wing of an aeroplane are v_1 and v_2, respectively. If A is the cross-sectional area of the wing and ρ is the density of air, then the upward lift is

(a) $\frac{1}{2}\rho A(v_1 - v_2)$ (b) $\frac{1}{2}\rho A(v_1 + v_2)$
(c) $\frac{1}{2}\rho A(v_1^2 - v_2^2)$ (d) $\frac{1}{2}\rho A(v_1^2 + v_2^2)$

56. Two cells with the same emf E and different internal resistances r_1 and r_2 are connected in series to an external resistance R. If the potential difference across the first cell is zero then value of R.

(a) $\sqrt{r_1 r_2}$ (b) $r_1 + r_2$
(c) $r_1 - r_2$ (d) $\frac{r_1 + r_2}{2}$

57. A string vibrates with a frequency of 200 Hz . When its length is doubled and tension is altered, it begins to vibrate with a frequency of 300 Hz . The ratio of the new tension to the original tension is

(a) 9: 1 (b) 1: 9
(c) 3: 1 (d) 1: 3

58. When 10^{19} electrons are removed from a neutral metal plate, the electric charge on it is

(a) -1.6 C (b) +1.6 C
(c) 10^{+19}C (d) 10^{-19}C

59. In an electrical circuit R, L, C and AC voltage source are all connected in series. When L is removed from the circuit, the phase difference between the voltage and the current in the circuit is $\pi/3$. If instead C is removed from the circuit, the phase difference is again $\pi/3$. The power factor of the circuit is

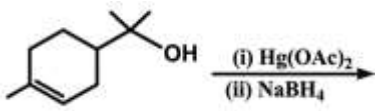
(a) ½ (b) $1\sqrt{2}$
(c) 1 (d) $\frac{\sqrt{3}}{2}$

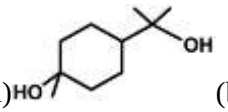
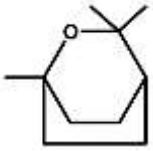
CHEMISTRY

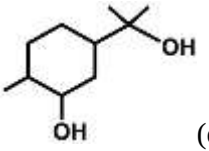
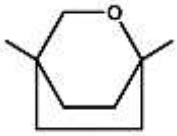
60. Which of the following hexoses will form the same osazone when treated with excess phenyl hydrazine?

(a) D-glucose, D-fructose and D-galactose
(b) D-glucose, D-fructose and D-mannose
(c) D-glucose, D-mannose and D-galactose
(d) D-fructose, D-mannose and D-galactose

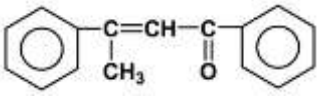
61. Product of the following reaction is

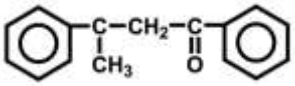


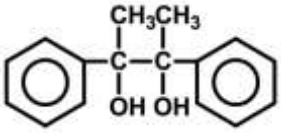
(a)  (b) 

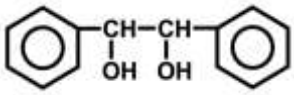
(c)  (d) 

62. Acetophenone when reacted with a base, C_2H_5ONa, yields a stable compound which has the structure

(a) 

(b) 

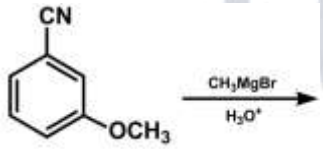
(c) 

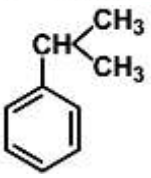
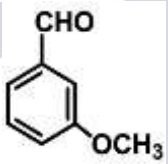
(d) 

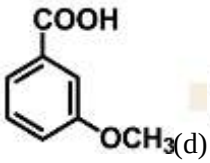
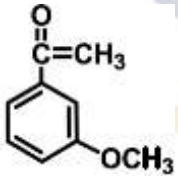
63. Gabriel's synthesis is used frequency for the preparation of which of the following?

(a)1° amines (b)1° alcohols
(c)3° amines (d)3° alcohols

64. The product P in the reaction,



(a)  (b) 

(c)  (d) 

65. Pick out the incorrect statement(s) from the following.

(1) Glucose exists in two different crystalline forms, α-D-glucose and β -D-glucose.
(2) α-D-glucose and β-D-glucose are anomers.
(3) α-D-glucose and β-D-glucose are enantiomers.
(4) Cellulose is a straight chain polysaccharide made of only β-Dglucose units.
(5) Starch is a mixture of amylase and amylopectin, both contain unbranched chain of α-D-glucose units.

(a)1 and 2 only (b)2 and 3 only
(c)3 and 4 only (d)3 and 5 only

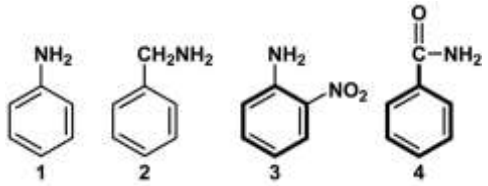
66. Which of the following is incorrect?

(a)Primary alcohols are very easily oxidised to aldehydes, which are oxidised to acids with same number of C - atoms.

(b)Secondary alcohols are very easily oxidised to ketones, which are oxidised to acids with same number of C - atoms.

(c)Secondary alcohols are easily oxidised to ketones, which are oxidised to acids with lsser number of C -atoms.
(d)Secondary and tertiary alcohols on oxidation form acids with lesser number of Catoms.

67. Rank the following compounds in order of increasing basicity.



(a)$(4) < (2) < (1) < (3)$
(b)$(4) < (1) < (3) < (2)$
(c)$(4) < (3) < (1) < (2)$
(d)$(2) < (1) < (3) < (4)$

68. Ammoniacal silver nitrate forms a white precipitate easily with

(a)$CH_3C = CH$ (b)$CH_3C = CCH_3$
(c)$CH_3CH = CH_2$ (d)$CH_2 = CH_2$

69. Consider the following equilibrium,$2No(g) \rightleftharpoons N_2 + O_2; K_G = 2.4 \times 10^{20}$ $No(g) + \frac{1}{2}Br_2(g) \rightleftharpoons NoBr(g); K_{C_2} = 1.4$.Calculate K_C for the reaction,$\frac{1}{2}N_2(g) + \frac{1}{2}O_2(g) + \frac{1}{2}Br_2(g) \rightleftharpoons NOBr(g)$

(a)8.96×10^{-11} (b)9.48×10^{-9}
(c)8.08×10^{-12} (d)8.96×10^{11}

70. Which of the following is incorrect regarding Henry's law?

(a)Gas reacts with solvent chemically.
(b)Pressure and concentrations are not too high.
(c)Temperature is not too low.
(d)Gas does not change its molecular state in solution i.e., neither dissociates nor associates.

71. t-butyl chloride preferably undergo hydrolysis by

(a)S_N1 mechanism (b)S_N2 mechanism
(c)any of (a) and (b) (d)None of the above

72. Which of these represents the correct order of decreasing bond order?

(a)$C_2^{2-} > O_2^{2+} > O_2^- > He_2^{2+}$
(b)$O_2^- > O_2^+ > He_2^+ > C_2^{2-}$
(c)$He_2^+ > O_2^- > C_2^{2-} > O_2^+$
(d)$He_2^+ > O_2^{2-} > O_2^+ > O_2^-$

73. In a 0.2 M aqueous solution, lactic acid is 6.9% dissociated. The value of dissociation constant is

(a)1.2×10^{-4} (b)9.5×10^{-4}
(c)6.5×10^{-4} (d)3.6×10^{-2}

74. Pick up the correct statement.

(a)Dipole moment of ammonia is due to orbital dipole and resultant diapole in same direction.
(b)O_2, H_2 shown bond diapole due to polarisation.
(c)Dipole moment is scalar quantity.
(d)In BF_3 bond dicopoles are zero but dipole moment is higher.

75. Total number of σ and π bonds in ethene molecule is

(a)1σ and 2π bonds (b)5σ and 1π bonds
(c)5σ and 2π bonds (d)3σ and 1π bonds

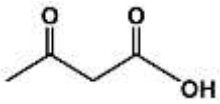
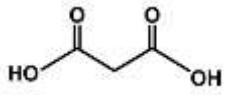
76. A buffer solution has equal volumes of $0.1MNH_4OH$ and $0.01MNH_4Cl$. The pK_b of the base is 5 . The pH is

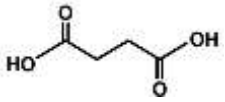
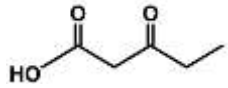
(a)10 (b)9
(c)4 (d)7

77. Assuming no change in volume, the time required to obtain solution of $pH = 4$ by electrolysis of 100 mL of 0.1 M NaOH (using current 0.5 A will be

(a)1.93 s (b)2.63 s
(c)1.80 s (d)4.26 s

78. Which of the following compounds would not be expected to decarboxylate when heated?

(a)  (b) 

(c)  (d) 

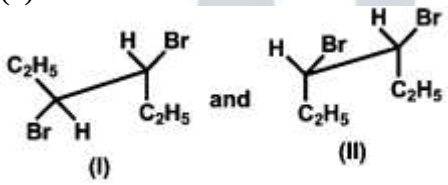
79. Which of these molecules have non-bonding electron pairs on the cental atom?
I: SF_4: II: ICl_3: III: SO_2
(a)II only (b)I and II only
(c)I and III only (d)I, II and III

80. For a cell reaction, $A(s) + B^{2+}(aq) \rightarrow A^{2+}(aq) + B(s)$; the standard emf of the cell is 0.295 V at 25°C. The equilibrium constant at 25°C will be
(a)1×10^{10} (b)10
(c)2.95×10^{-2} (d)2.95×10^{-10}

81. Which of the following shows negative deviation from Raoult's law?
(a)Benzene-acetone
(b)Benzene-chloroform
(c)Benzene-ethanol
(d)Benzene-carbon tetrachloride

82. 5 g of non-volatile water soluble compound X is dissolved in 100 g of water. The elevation in boiling point is found to be 0.25 . The molecular mass of compound X is
(a)35 g (b)40 g
(c)20 g (d)60 g

83. The correct decreasing order of negative electron gain enthalpy for C, Ca, Al, F and O is
(a)F > O > C > Al > Ca
(b)Ca > Al > O > F > C
(c)Al > F > Ca > C > O
(d)F > C > O > Ca > Al

84. 

(I) and (II) are
(a)identical
(b)a pair of conformers
(c)a pair of geometrical isomers
(d)a pair of optical isomers

85. Ti^{2+} is purple while Ti^{4+} is colourless because
(a)Ti^{2+} has $3d^2$ configuration
(b)Ti^{4+} has $3d^2$ configuration
(c)Ti^{2+} is very small cation when compared to Ti^{2+} and hence, doesn't absorb any radiation
(d)There is no crystal field effect in Ti^{4+}

86. In Friedal-Crafts alkylation reaction of phenol with chloromethane, the product formed will be
(a)p-cresol only
(b)m-cresol only
(c)mixture of o-and p-cresol
(d)o-cresol only

87. Which among the following is diamagnetic?

(a)$[Ni(CN)_4]^{2-}$ (b)$[Co(F_6)]^{3-}$

(c)$[NiCl_4]^{2-}$ (d)$[Fe(CN)_6]^{3-}v$

88. Which one of the following is an important component of chlorophyll?

(a)Mn (b)Mg

(c)Fe (d)Zn

89. A volatile compound is formed by carbon monoxide and Options:

(a)Cu (b)Al

(c)Ni (d)Si

90. The complex $[PtCl_2(en)_2]^{2+}$ ion shows

(a)structural isomerism

(b)geometrical isomerism only

(c)optical isomerism only

(d)geometrical and optical isomerism

91. 15 g of $CaCO_3$ completely reacts with

(a)6.95 g of HCl (b)10.95 g of HCl

(c)11.95 g of HCl (d)1.15 g of HCl

92. Bohr's radius of 2 nd orbit of Be^{3+} is equal to that of Options:

(a)4th orbit of hydrogen

(b)2nd orbit of He^+

(c)3rd obit of Li^{2+}

(d)1st orbit of hydrogen

93. How much faster would a reaction proceed at $25^\circ C$ than at $0^\circ C$ if the activation energy is 65 kJ ?

(a)4 times (b)6 times

(c)12 times (d)11 times

94. The blue colouration obtained from the Lassaigne's test of nitrogen is due to the formation of

(a)$Fe_4[Fe(CN)_6]_3$ (b)$Fe_2[Fe(CN)_6]_5$

(c)$K_2[Fe(CN)_6]_5$ (d)$K_4[Fe(CN)_6]_3$

95. The ion that is isoelectronic with CO is Options:

(a)O_2^+ (b)CN^-

(c)O_2^- (d)N_2^+

96. At 300 K , the half-life period of a gaseous reaction at an initial pressure of 40 kPa is 350 s . When pressure is 20 kPa , the half-life period is 175 s . What is the order of the reaction?

(a)Three (b)Two

(c)One (d)Zero

97. If 2 moles of $C_6H_6(g)$ are completely burnt 4100 kJ of heat is liberated. If ΔH° for $CO_2(g)$ and $H_2O(l)$ are -410 and -285 kJ per mole respectively then the heat of formation of $C_2H_6(g)$ is

(a)-116 kJ (b)-375 kJ

(c)-775 kJ (d)-885 kJ

98. Abnormal colligative properties are observed only when the dissolved non-volatile solute in a given dilute solution

(a)is a non-electrolyte

(b)offers an intense colour

(c)associates and dissociates

(d)offers no colour

99. Aqueous $CuSO_4$ changes its colour from sky blue to deep blue on addition of NH_3 because

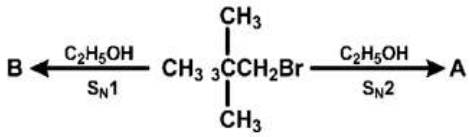
(a)Cu^{2+}forms hydrate

(b)Cu^{2+}changes to Cu^+

(c)$[Cu(H_2O)_4]^{2+}$is labile complex and changes to $[Cu(NH_3)_4]^{2+}$as NH_3 is stronger ligand than H_2O

(d)Cu^+changes to Cu^{2+}

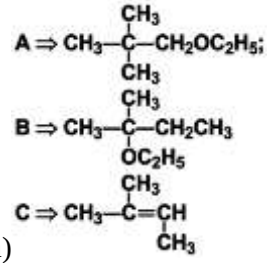
100.



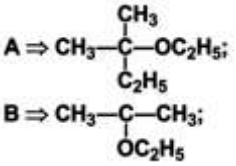
$\xrightarrow[\text{Elimination}]{}$ C

Identify (A), (B) and (C).

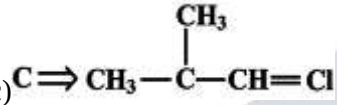
(a)



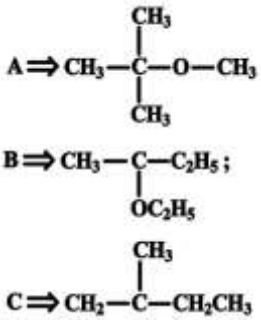
(b)



(c)



(d)



101. For a reaction, $2A + B \longrightarrow$ products, If concentration of B is kept constant and concentration of A is doubled then rate of reaction is

(a)doubled (b)quadrupled
(c)halved (d)remain same

102. For an adiabatic change in a system, the condition which is applicable is

(a)$q = 0$ (b)$w = 0$
(c)$q = -w$ (d)$q = w$

103. In dilute alkaline solution MnO_4^- changes to

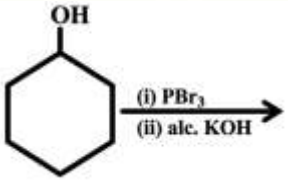
(a)MnO_2 (b)MnO_4^{2-}
(c)MnO (d)Mn_2O_3

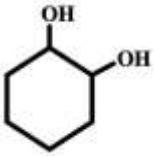
104. Which of the following complex show optical isomerism?

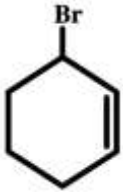
(i)cis $-[COCl(en)_2(NH_3)]^{2+}$
(ii)cis $-[CrCl_2(ox)_2]^{3-}$
(iii)cis $-[CO(en)_2Cl_2]Cl$
(iv)cis $-[CO(NH_3)_4Cl_2]^+$

(a)(i), (ii), (iii) (b)(i), (ii)
(c)(i), (iv) (d)(i), (ii), (iv)

105.



(a)  (b) 

(c) 

(d) 

106. Mohr's salt has the formula

(a)$FeSO_4 \cdot 7H_2O$

(b)$FeSO_4(NH_4)_2SO_4 \cdot 6H_2O$

(c)$Fe(SO_4)_3(NH_4)_2SO_4 \cdot 6H_2O$

(d)$MgSO_4 \cdot 7H_2O$

MATHEMATICS

107. The value of $a^{\log_b c} - c^{\log_b a}$, where $a, b, c > 0$ but $a, b, c \neq 1$, is

(a)a (b)b

(c)c (d)0

108. The slope of the tangent to the curve, $y = x^2 - xy$ at $\left(1, \frac{1}{2}\right)$ is Options:

(a)$\frac{4}{3}$ (b)$\frac{2}{3}$

(c)$\frac{3}{4}$ (d)$\frac{3}{2}$

109. The value of $\lim_{x\to 0} \frac{e^{ax} - e^{bx}}{2x}$ is equal to

(a)$\frac{a+b}{2}$ (b)$\frac{a-b}{2}$

(c)$\frac{e^{ab}}{2}$ (d)0

110. The points of intersection of circles $(x+1)^2 + y^2 = 4$ and $(x-1)^2 + y^2 = 9$ are $(a, \pm b)$, then (a, b) equals to

(a)$\left(1.25, \frac{3}{4}\sqrt{7}\right)$ (b)$\left(-1.25, \frac{3}{4}\sqrt{7}\right)$

(c)$(-1,2)$ (d)$(1,3)$

111. The approximate value of $f(5.001)$, where $f(x) = x^3 - 7x^2 + 10$

(a)-39.995 (b)-38.995

(c)-37.335 (d)-40.995

112. The circle $x^2 + y^2 + 3x - y + 2 = 0$ cuts an intercept on X-axis of length

(a)3 (b)4

(c)2 (d)1

113. Let $f(x) = a + (x-4)^{\frac{4}{9}}$, then minima of $f(x)$ is

(a)4 (b)a

(c)a-4 (d)None of these

114. If $f(x) = \begin{cases} 2\sin x & ; \ -\pi \le x \le \frac{-\pi}{2} \\ a\sin x + b & ; \ -\frac{\pi}{2} < x < \frac{\pi}{2} \\ \cos x & ; \ \frac{\pi}{2} \le x \le \pi \end{cases}$ and it is continuous on $[-\pi, \pi]$, then

(a)$a = 1$ and $b = 1$ (b)$a = -1$ and $b = -1$
(c)$a = -1$ and $b = 1$ (d)$a = 1$ and $b = -1$

115. The value of $\lim_{x\to\infty}\left(\frac{x^2-2x+1}{x^2-4x+2}\right)^{2x}$ is

(a)e^2 (b)e^4
(c)e (d)e^{16}

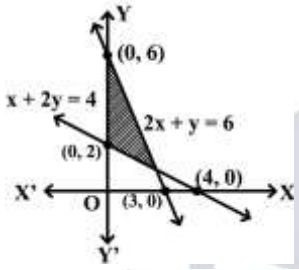
116. $S \equiv x^2 + y^2 - 2x - 4y - 4 = 0$ and $S' \equiv x^2 + y^2 - 4x - 2y - 16 = 0$ are two circles the point $(-2, -1)$ lies

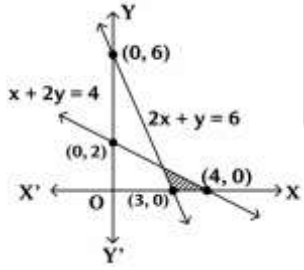
(a)inside S' only (b)inside S only
(c)inside S and s' (d)outside S and S'

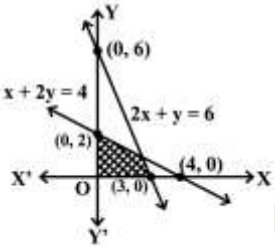
117. A number n is chosen at random from $s = \{1, 2, 3, \ldots, 50\}$. Let $A = \{n \in s: n$ is a square $\}$, $B = \{n \in s: n$ is a prime $\}$ and $C = \{n \in s: n$ is a square $\}$. Then, correct order of their probabilities is

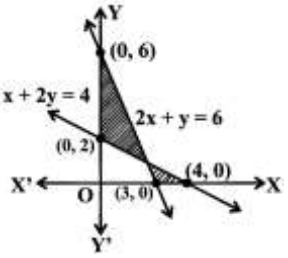
(a)$p(A) < p(B) < p(C)$
(b)$p(A) > p(B) > p(C)$
(c)$p(B) < p(A) < p(C)$
(d)$p(A) > p(c) > p(B)$

118. The feasible region for the inequations $x + 2y \geq 4, 2x + y \leq 6, x, y \geq 0$ is

(a)


(b)


(c)


(d)


119. The maximum value of $Z = 10x + 16y$, subject to constraints $x \geq 0, y \geq 0, x + y \leq 12, 2x + y \leq 20$ is

(a)144 (b)192
(c)120 (d)240

120. If $A = \begin{bmatrix} 2 & 2 \\ 3 & 4 \end{bmatrix}$, then A^{-1} equals to

(a) $\begin{bmatrix} 2 & 1 \\ -3/2 & -1 \end{bmatrix}$ (b) $\begin{bmatrix} 2 & -1 \\ -3/2 & 1 \end{bmatrix}$

(c) $\begin{bmatrix} -2 & 1 \\ 3/2 & -1 \end{bmatrix}$ (d) $\begin{bmatrix} -2 & -1 \\ 3/2 & 1 \end{bmatrix}$

121. If A is a matrix of order 4 such that $A(adjA) = 10I$, then $|adjA|$ is equal to

(a)10 (b)100

(c)1000 (d)10000

122. If $A = \begin{bmatrix} k+1 & 2 \\ 4 & k-1 \end{bmatrix}$ is a singular matrix, then possible values of k are

(a)± 1 (b)± 2

(c)± 3 (d)± 4

123. The angle between the vectors $a = \hat{i} + 2\hat{j} + 2\hat{k}$ and $b = \hat{i} + 2\hat{j} - 2\hat{k}$ is Options:

(a)$\sin^{-1}(1/9)$ (b)$\sin^{-1}(8/9)$

(c)$\cos^{-1}(8/9)$ (d)$\cos^{-1}(1/9)$

124. If the vectors $a = 2\hat{i} - 3\hat{j} + 4\hat{k}; b = \hat{i} + 2\hat{j} - \hat{k}$ and $c = m\hat{i} - \hat{j} + 2\hat{k}$ are coplanar, then the value of m is

(a)$\frac{5}{8}$ (b)$\frac{8}{5}$

(c)$\frac{-7}{4}$ (d)$\frac{2}{3}$

125. The maximum value of $Z = 12x + 13y$, subject to constraints $x \geq 0, y \geq 0, x + y \leq 5$ and $3x + y \leq 9$ is

(a)63 (b)65

(c)60 (d)117

126. $a = 2\hat{i} + \hat{j} - \hat{k}, b = \hat{i} - \hat{j}$ and $c = 5\hat{i} - \hat{j} + \hat{k}$, then unit vector parallel to $a + b - c$ but in opposite direction is

(a)$\frac{1}{3}(2\hat{i} - \hat{j} + 2\hat{k})$ (b)$\frac{1}{2}(2\hat{i} - \hat{j} + 2\hat{k})$

(c)$\frac{1}{3}(2\hat{i} - \hat{j} - 2\hat{k})$ (d)None of these

127. The place $x - 2y + z = 0$ is parallel to the line

(a)$\frac{x-3}{4} = \frac{y-4}{5} = \frac{z-3}{6}$ (b)$\frac{x-2}{1} = \frac{y-2}{-2} = \frac{z-3}{1}$

(c)$\frac{x-2}{2} = \frac{y-3}{3} = \frac{z-4}{4}$ (d)$\frac{x-4}{3} = \frac{y-5}{4} = \frac{z-6}{3}$

128. $\int \frac{xdx}{2(1+x)^{3/2}}$ is equal to

(a)$\frac{2+x}{\sqrt{1+x}} + C$ (b)$\frac{2+x}{x\sqrt{1+x}} + C$

(c)$\frac{x}{\sqrt{1+x}} + C$ (d)$-\frac{x}{\sqrt{1}} + C$

129. $\int \frac{4^x}{\sqrt{1-16^x}} dx$ is equal to

(a)$(\log 4)\sin^{-1}4^x + C$ (b)$\frac{1}{4}\sin^{-1}(4^x) + C$

(c)$\frac{1}{\log 4}\sin^{-1}4^x + C$ (d)$4\log 4 \sin^{-1}4 + C$

130. $\int_{-\pi/2}^{\pi/2} \sin^2 x dx$ is equal to

(a)0 (b)π

(c)$\frac{\pi}{2}$ (d)$\frac{\pi}{4}$

131. The lines $\frac{x-1}{2} = \frac{y-4}{4} = \frac{z-2}{3}$ and $\frac{1-x}{1} = \frac{y-2}{5} = \frac{3-z}{a}$ are perpendicular to each other, then a equals to

(a)-6 (b)6

(c) $\frac{22}{3}$ (d) $-\frac{22}{3}$

132. If two lines $L_1: \frac{x-1}{2} = \frac{y+1}{3} = \frac{z-1}{4}$ and $L_2: \frac{x-3}{1} = \frac{y-k}{2} = z$ intersect at a point, then 2k is equal to

(a)9 (b)$\frac{1}{2}$
(c)$\frac{9}{2}$ (d)1

133. A five-digits number is formed by using the digits $1, 2, 3, 4, 5$ with no repetition. The probability that the numbers 1 and 5 are always together, is

(a) $\frac{2}{5}$ (b) $\frac{1}{5}$
(c) $\frac{3}{5}$ (d) $\frac{1}{4}$

134. If a number n is chosen at random from the set $\{11, 12, 13, \ldots\ldots, 30\}$. Then, the probability that n is neither divisible by 3 nor divisible by 5 , is

(a)$\frac{7}{20}$ (b)$\frac{9}{20}$
(c)$\frac{11}{20}$ (d)$\frac{13}{20}$

135. Three vertices are chosen randomly from the nine vertices of a regular 9-sided polygon. The probability that they form the vertices of an isosceles triangle, is

(a)$\frac{4}{7}$ (b)$\frac{3}{7}$
(c)$\frac{2}{7}$ (d)$\frac{5}{7}$

136. If A, B and C are mutually exclusive and exhaustive events of a random experiment such that $P(B) = \frac{3}{2}P(A)$ and $P(C) = \frac{1}{2}P(B)$, then $P(A \cup C)$ equals to

(a)$\frac{10}{13}$ (b)$\frac{3}{13}$
(c)$\frac{6}{13}$ (d)$\frac{7}{13}$

137. Using mathematical induction, the numbers $a_n\delta$ are defined by $a_0 = 1, a_{n+1} = 3n^2 + n + a_n, (n \geq 0)$. Then, a_n is equal to

(a)$n^3 + n^2 + 1$ (b)$n^3 - n^2 + 1$
(c)$n^3 - n^2$ (d)$n^3 + n^2$

138. If $49^n + 16^n + k$ is divisible by 64 for $n \in N$, then the least negative integral value of k is

(a)-1 (b)-2
(c)-3 (d)-4

139. $2^{3n} - 7n - 1$ is divisible by

(a)64 (b)36
(c)49 (d)25

140. The sum of n terms of the series, $\frac{4}{3} + \frac{10}{9} + \frac{28}{27} + \cdots$ is

(a)$\frac{3^n(2n+1)+1}{2(3^n)}$ (b)$\frac{3^n(2n+1)-1}{2(3^n)}$
(c)$\frac{3^n n-1}{2(3^n)}$ (d)$\frac{3^n-1}{2}$

141. The value of $\frac{1}{2!} + \frac{2}{3!} + \cdots + \frac{99}{100!}$ is equal to

(a)$\frac{100!-1}{100!}$ (b)$\frac{100!+1}{100!}$
(c)$\frac{999!-1}{999!}$ (d)$\frac{999!+1}{999!}$

142. If the sum of 12th and 22nd terms of an AP is 100 , then the sum of the first 33 terms of an AP is

(a)1700 (b)1650
(c)3300 (d)3500

143. The differential equation of all non-vertical lines in a plane is

(a)$\frac{d^2y}{dx^2} = 0$ (b)$\frac{d^2x}{dy^2} = 0$
(c)$\frac{dy}{dx} = 0$ (d)$\frac{dx}{dy} = 0$

144. The general solution of $\left(\frac{dy}{dx}\right)^2 = 1 - x^2 - y^2 + x^2y^2$ is

(a) $2\sin^{-1}y = x\sqrt{1-x^2} + \sin^{-1}x + C$

(b) $\cos^{-1}y = x\cos^{-1}x$

(c) $\sin^{-1}y = \frac{1}{2}\sin^{-1}x + C$

(d) $2\sin^{-1}y = x\sqrt{1-y^2} + C$

145. The solution of the differential equation $\left(\frac{dy}{dx}\right)\tan y = \sin(x+y) + \sin(x-y)$ is

(a) $\sec x = -2\sec y + C$

(b) $\sec y = 2\cos y + C$

(c) $\sec y = -2\cos x + C$

(d) $\sec x = -2\cos y + C$

146. Find ${}^nC_{21}$, if ${}^nC_{10} = {}^nC_{12}$

(a) 1 (b) 21

(c) 22 (d) 2

147. In a trial, the probability of success is twice the probability of failure. In six trials, the probability of at most two failure will be

(a) $\frac{600}{729}$ (b) $\frac{500}{729}$

(c) $\frac{400}{729}$ (d) $\frac{496}{729}$

148. If $\cos A = m\cos B$ and $\cot\left(\frac{A+B}{2}\right) = \lambda\tan\left(\frac{B-A}{2}\right)$, then λ is equal to

(a) $\frac{m}{m-1}$ (b) $\frac{m+1}{m}$

(c) $\frac{m+1}{m-1}$ (d) none of these

149. The expression $\frac{2\tan A}{1-\cot A} + \frac{2\cot A}{1-\tan A}$ can be written as

(a) $\sin 2A + \cos 2A$

(b) $2\sec A\operatorname{cosec} A + 2$

(c) $\tan 2A + \cot 2A$

(d) $\sec 2A + \operatorname{cosec} 2A$

150. The general solution of $2\cos 4x + \sin^2 2x = 0$ is

(a) $x = \frac{n\pi}{2} \pm \sin^{-1}\left(\frac{1}{5}\right)$

(b) $x = \frac{n\pi}{4} + \frac{(-1)^n}{4}\sin^{-1}\left(\pm\frac{2\sqrt{2}}{3}\right)$

(c) $x = \frac{n\pi}{2} \pm \cos^{-1}\left(\frac{1}{5}\right)$

(d) $x = \frac{n\pi}{4} + \frac{(-1)^n}{4}\cos^{-1}\left(\frac{1}{5}\right)$

151. If $2f(x^2) + 3f\left(\frac{1}{x^2}\right) = x^2 - 1, \forall x \in R - \{0\}$, then $f(x^8)$ is equal to

(a) $\frac{(1-x^8)(2x^8+3)}{5x^8}$ (b) $\frac{(1+x^8)(2x^8-3)}{5x^8}$

(c) $\frac{(1-x^8)(2x^8-3)}{5x^8}$ (d) none of these

152. If $A = \{a, b, c\}, B = \{b, c, d\}$ and $C = \{a, d, c\}$ then $(A - B) \times (B \cap C)$ is equal to

(a) $\{(a, c), (a, d)\}$ (b) $\{(a, b), (c, d)\}$

(c) $\{(c, a), (d, a)\}$ (d) $\{(a, c), (a, d), (b, d)\}$

153. If $n(A) = p$ and $n(B) = q$, then the numbers of relations from the set A to the set B is

(a) 2^{p+q} (b) 2^{pq}

(c) $p + q$ (d) pq

154. If $z = \sqrt{3} + i$, then the argument of z^2e^{z-i} is equal to

(a) $e^{\pi/3}$ (b) $\frac{\pi}{3}$

(c) $\frac{\pi}{6}$ (d) $e^{\pi/6}$

155. If $i = \sqrt{-1}$ and n is a positive integer, then $i^n + i^{n+1} + i^{n+2} + i^{n+3}$ is equal to

(a)1 (b)i

(c)i^n (d)0

156. If $\left(\frac{3}{2} + i\frac{\sqrt{3}}{2}\right)^{50} = 3^{25}(x + iy)$, where x and y are real, then the ordered pair $(2x, 2y)$ is

(a)$(-6,0)$ (b)$(0,6)$

(c)$(0,-6)$ (d)$(1,\sqrt{3})$

157. There are 10 points in a plane out of which 4 points are collinear. How many straight lines can be drawn by joining any two of them?

(a)39 (b)40

(c)45 (d)21

158. The total number of numbers greater than 1000 but less than 4000 that can be formed using $0, 2, 3, 4$ (using repetition allowed) are

(a)125 (b)105

(c)128 (d)625

159. A polygon of n sides has 105 diagonals, then n is equal to

(a)20 (b)21

(c)15 (d)-14

160. Let the equation of pair of lines $y = m_1x$ and $y = m_2x$ can be written as $(y - m_1x)(y - m_2x) = 0$. Then, the equation of the pair of the angle bisector of the line $3y^2 - 5xy - 2x^2 = 0$ is

(a) $x^2 + 5xy - y^2 = 0$ (b) $x^2 - 5xy + y^2 = 0$

(c) $x^2 - xy + y^2 = 0$ (d) $x^2 + xy - y^2 = 0$

161. The distance of the point $(3, 4)$ from the line $3x + 2y + 7 = 0$ measured along the line parallel to $y - 2x + 7 = 0$ is equal to

(a)$\frac{24\sqrt{5}}{7}$ (b)$3\sqrt{5}$

(c)$\frac{23\sqrt{5}}{7}$ (d)$4\sqrt{5}$

162. The slope of lines which makes an angle 60° with the line $y - 3x + 18 = 0$

(a)$\frac{3\sqrt{3}-3}{1+3\sqrt{3}}, \frac{3\sqrt{3}-3}{1+3\sqrt{3}}$ (b)$\frac{3-\sqrt{3}}{1+3\sqrt{3}}, \frac{3+\sqrt{3}}{1-3\sqrt{3}}$

(c)$\frac{3}{1+\sqrt{3}}, \frac{3}{1-\sqrt{3}}$ (d)$\frac{\sqrt{3}-1}{3}, \frac{\sqrt{3}+1}{3}$

163. 3 and 5 are intercepts of a line $L = 0$, then the distance of $L = 0$ from $(3, 7)$ is

(a)$\sqrt{31}$ (b)$\sqrt{34}$

(c)$\frac{21}{\sqrt{34}}$ (d)$\frac{\sqrt{34}}{31}$

164. The total number of terms in the expansion of $(x + y)^{60} + (x - y)^{60}$ is

(a)60 (b)61

(c)30 (d)31

165. The coefficient of x^{29} in the expansion of $(1 - 3x + 3x^2 - x^3)^{15}$ is

(a) ${}^{45}C_{29}$ (b) ${}^{45}C_{28}$

(c)$-{}^{45}C_{16}$ (d) ${}^{45}C_{30}$

166. In the expansion of $(1 + 3x + 3x^2 + x^3)^{2n}$, the term which has greatest binomial coefficient, is

(a)(3n) th term (b)$(3n + 1)$ th term

(c)$(3n - 1)$ th term (d)$(3n + 2)$ th term