Q1. A bullet loses $\left(\frac{1}{n}\right)^{\text{th}}$ of its velocity passing through one plank. Considering uniform retardation, the number of such planks that are required to stop the bullet can be:

(1) Infinite (2) n

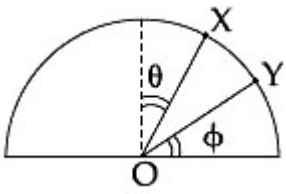
(3) $\frac{n^2}{(2n-1)}$ (4) $\frac{2n^2}{(n-1)}$

Q2. A heavy box is to be dragged along a rough horizontal floor. To do so, the person A pushes it at an angle 30° from the horizontal and requires a minimum force F_{A}, while the person B pulls the box at an angle 60° from the horizontal and needs minimum force F_{B}. If the coefficient of friction between the box and the floor is $\frac{\sqrt{3}}{5}$, the ratio $\frac{F_{\text{A}}}{F_{\text{B}}}$ is

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

(3) $\sqrt{3}$ (4) $\frac{5}{\sqrt{3}}$

Q3.

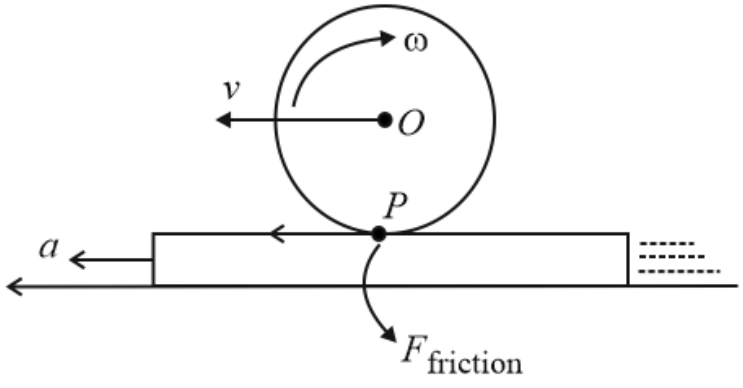


A particle is released on a vertical smooth semicircular track from point X so that, OX makes angle θ from the vertical (see figure). The normal reaction of the track on the particle vanishes at the point Y where OY makes an angle ϕ with the horizontal. Then

(1) $\sin\phi = \frac{2}{3}\cos\theta$ (2) $\sin\phi = \frac{3}{4}\cos\theta$

(3) $\sin\phi = \frac{1}{2}\cos\theta$ (4) $\sin\phi = \cos\theta$

Q4. Consider a cylinder of mass M resting on a rough horizontal rug that is pulled out from under it with acceleration 'a' perpendicular to the axis of the cylinder. What is F_{friction} at point P ? It is assumed that the cylinder does not slip.



(1) Ma (2) $\frac{\text{Ma}}{2}$

(3) $\frac{\text{Ma}}{3}$ (4) Mg

Q5. A ball of mass 160 g is thrown up at an angle of 60° to the horizontal at a speed of 10 m s^{-1}. The angular momentum of the ball at the highest point of the trajectory with respect to the point from which the ball is thrown is nearly $\left(\text{g} = 10 \text{ m s}^{-2}\right)$

(1) $1.73\ \text{kg m}^2\ \text{s}^{-1}$ (2) $3.46\ \text{kg m}^2\ \text{s}^{-1}$
(3) $3.0\ \text{kg m}^2\ \text{s}^{-1}$ (4) $6.0\ \text{kg m}^2\ \text{s}^{-1}$

Q6. Match List-I (Event) with List-II (Order of the time interval for the happening of the event) and select the correct option from the options given below the lists.

	List-I		**List-II**
(a)	The rotation period of earth	(i)	10^5 s
(b)	Revolution period of earth	(ii)	10^7 s
(c)	Period of a light wave	(iii)	10^{-15} s
(d)	Period of a sound wave	(iv)	10^{-3} s

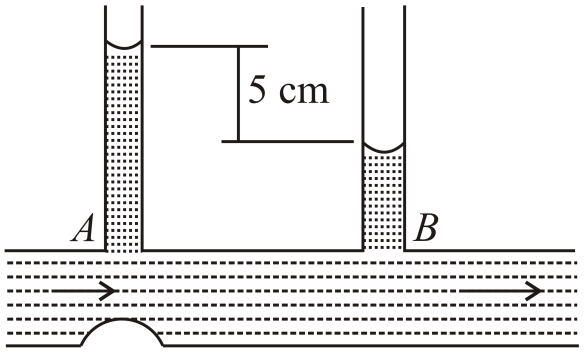
(1) (a)-(i), (b)-(ii), (c)-(iii), (d)-(iv) (2) (a)-(ii), (b)-(i), (c)-(iii), (d)-(iv)
(3) (a)-(i), (b)-(ii), (c)-(iv), (d)-(iii) (4) (a)-(ii), (b)-(i), (c)-(iv), (d)-(iii)

Q7. The gravitational field in a region is given by $\vec{g} = \left(5\hat{\text{i}} + 12\hat{\text{j}}\right)\ \text{N kg}^{-1}$. The change in the gravitational potential energy of a particle of mass 2 kg when it is taken from the origin to a point $(7\ \text{m}, -3\ \text{m})$ is
(1) 71 J (2) $13\sqrt{58}$ J
(3) 2 J (4) 1 J

Q8. The velocity of water in a river is $18\ \text{km h}^{-1}$ near the surface. If the river is 5 m deep, find the shearing stress between the horizontal layers of water. The coefficient of viscosity of water$= 10^{-2}$ poise.
(1) $10^{-4}\ \text{N m}^{-2}$ (2) $10^{-3}\ \text{N m}^{-2}$
(3) $10^{-2}\ \text{N m}^{-2}$ (4) $10^{-1}\ \text{N m}^{-2}$

Q9. A large number of liquid drops each of radius r coalesce to form a single drop of the radius R. The energy released in the process is converted into kinetic energy of the big drop so formed. The speed of the big drop is (given surface tension of the liquid T, density ρ)
(1) $\sqrt{\frac{2T}{\rho}\left(\frac{1}{r} - \frac{1}{R}\right)}$ (2) $\sqrt{\frac{6T}{\rho}\left(\frac{1}{r} - \frac{1}{R}\right)}$
(3) $\sqrt{\frac{4T}{\rho}\left(\frac{1}{r} - \frac{1}{R}\right)}$ (4) $\sqrt{\frac{T}{\rho}\left(\frac{1}{r} - \frac{1}{R}\right)}$

Q10.



In the diagram shown, the difference in the two tubes of the manometer is 5 cm, the cross-section of the tube at A and B is $6\ \text{mm}^2$ and $10\ \text{mm}^2$ respectively. The rate at which water flows through the tube is $\left(g = 10\ \text{m s}^{-2}\right)$

(1) $7.5\ \text{cc s}^{-1}$ (2) $12.5\ \text{cc s}^{-1}$
(3) $8.0\ \text{cc s}^{-1}$ (4) $10.0\ \text{cc s}^{-1}$

Q11. A black coloured solid sphere of radius R and mass M is inside a cavity with a vacuum inside. The walls of the cavity are maintained at temperature T_0. The initial temperature of the sphere is $3T_0$. If the specific heat of the material of the sphere varies as αT^3 per unit mass with the temperature T of the sphere, where α is a constant, then the time taken for the sphere to cool down to temperature $2T_0$ will be
(σ is Stefan Boltzmann constant)
(1) $\frac{M\alpha}{16\pi R^2\sigma}\ln\left(\frac{3}{2}\right)$ (2) $\frac{M\alpha}{16\pi R^2\sigma}\ln\left(\frac{16}{3}\right)$
(3) $\frac{M\alpha}{4\pi R^2\sigma}\ln\left(\frac{3}{2}\right)$ (4) $\frac{M\alpha}{4\pi R^2\sigma}\ln\left(\frac{16}{3}\right)$

Q12. A monoatomic gas is compressed from a volume of $2\ \text{m}^3$ to a volume of $1\ \text{m}^3$ at a constant pressure of $100\ \text{N m}^2$. Then it is heated at constant volume by supplying $150\ \text{J}$ of energy. As a result, the internal energy of the gas
(1) Decreases by $50\ \text{J}$ (2) Increases by $250\ \text{J}$
(3) Decreases by $250\ \text{J}$ (4) $0\ \text{J}$

Q13. A gas molecule of mass M at the surface of the earth has kinetic energy equivalent to $0\ ^\circ\text{C}$. If it were to go up straight without colliding with any other molecules, how high it would rise? Assume that the height attained is much less than the radius of the earth. (k_B is Boltzmann constant)
(1) $\frac{273k_\text{B}}{2Mg}$ (2) $\frac{819k_\text{B}}{2Mg}$
(3) 0 (4) $\frac{546k_\text{B}}{3Mg}$

Q14. A body is in simple harmonic motion with time period $T = 0.5\,\text{s}$ and amplitude $A = 1\,\text{cm}$. Find the average velocity in the interval in which it moves from equilibrium position to half of its amplitude.
(1) $16\,\text{cm/s}$ (2) $6\,\text{cm/s}$
(3) $4\,\text{cm/s}$ (4) $12\,\text{cm/s}$

Q15. The total length of a sonometer wire fixed between two bridges is $110\ \text{cm}$. Now, two more bridges are placed to divide the length of the wire in the ratio $6:3:2$. If the tension in the wire is $400\ \text{N}$ and the mass per unit length of the wire is $0.01\ \text{kg m}^{-1}$, then the minimum common frequency with which all the three parts can vibrate, is
(1) $1000\ \text{Hz}$ (2) $1100\ \text{Hz}$
(3) $100\ \text{Hz}$ (4) $110\ \text{Hz}$

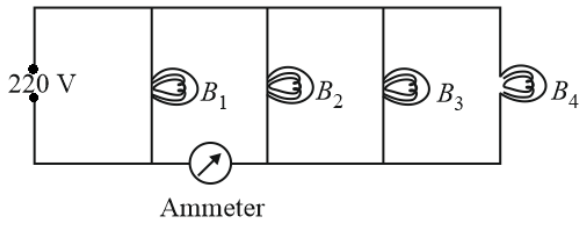
Q16. The electric field in a region of space is given by, $\vec{E} = E_0\hat{\text{i}} + 2E_0\hat{\text{j}}$ where $E_0 = 100\ \text{N C}^{-1}$. The flux of this field through a circular surface of radius $0.02\ \text{m}$ parallel to the Y-Z plane is nearly
(1) $0.02\ \text{N m}^2\ \text{C}^{-1}$ (2) $0.005\ \text{N m}^2\ \text{C}^{-1}$
(3) $0.125\ \text{N m}^2\ \text{C}^{-1}$ (4) $3.14\ \text{N m}^2\ \text{C}^{-1}$

Q17. The gap between the plates of a parallel plate capacitor of area A and distance between plates d, is filled with a dielectric whose relative permittivity varies linearly from ϵ_1 at one plate to ϵ_2 at the other. The capacitance of the capacitor is

(1) $\frac{\epsilon_0(\in_2-\in_1)A}{[d\ln(\in_2/\in_1)]}$ (2) $\frac{\epsilon_0(\in_2+\in_1)A}{2d}$

(3) $\frac{\epsilon_0(\in_1+\in_2)A}{d}$ (4) $\frac{\epsilon_0 A}{[d\ln(\in_2/\in_1)]}$

Q18.



Four bulbs B_1, B_2, B_3 and B_4 of 100 W each are connected to 220 V main as shown in the figure. The reading in an ideal ammeter will be

(1) 0.90 A (2) 1.35 A

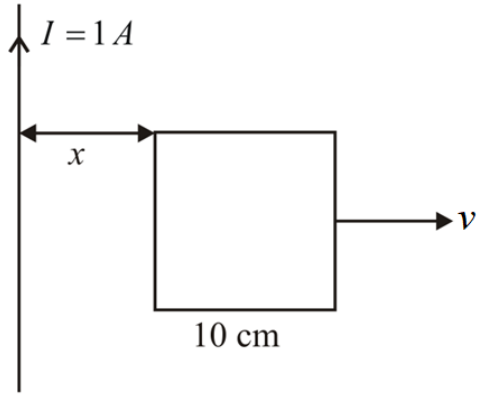
(3) 0.45 A (4) 1.80 A

Q19. An example of a perfect diamagnet is a superconductor. This implies that when a superconductor is put in a magnetic field of intensity B, the magnetic field B_s inside the superconductor will be such that

(1) $B_s = B$. (2) $B_s = 0$.

(3) $B_s < B$ but $B_s \neq 0$. (4) $B_s = -B$

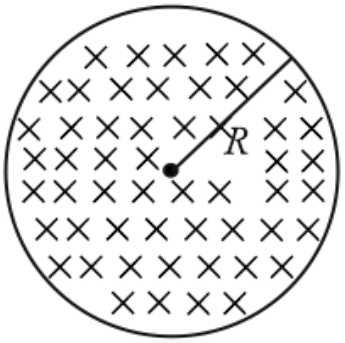
Q20. A square frame of side 10 cm and a long straight wire carrying current 1 A are in the plane of the paper. Starting from close to the wire, the frame moves towards the right with a constant speed of $10\ \text{m s}^{-1}$ (see figure). The e.m.f induced at the time the left arm of the frame is at $x = 10$ cm from the wire is



(1) $0.75\ \mu$V (2) $1\ \mu$V

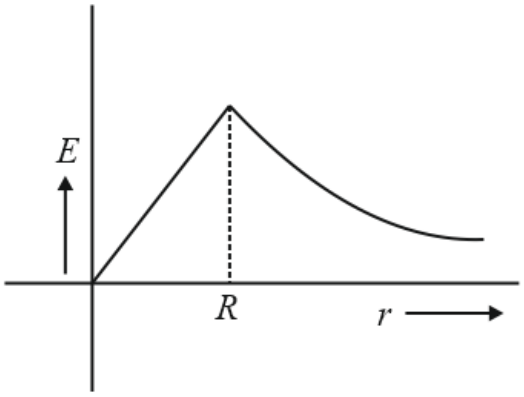
(3) $2\ \mu$V (4) $0.5\ \mu$V

Q21.

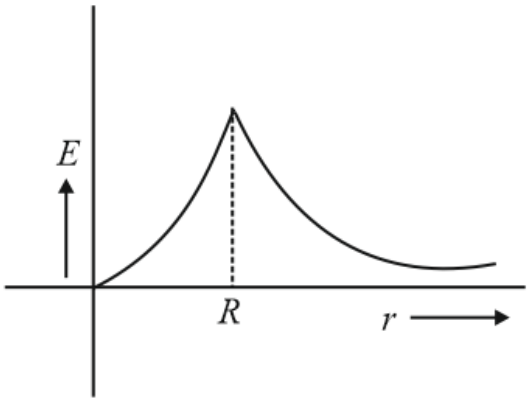


The figure shows a circular area of tthe radius R where a uniform magnetic field $\vec{B}$ is going into the plane of the paper and increasing in magnitude at a constant rate. In that case, which of the following graphs, drawn schematically, correctly shows the variation of the induced electric field $E(r)$?

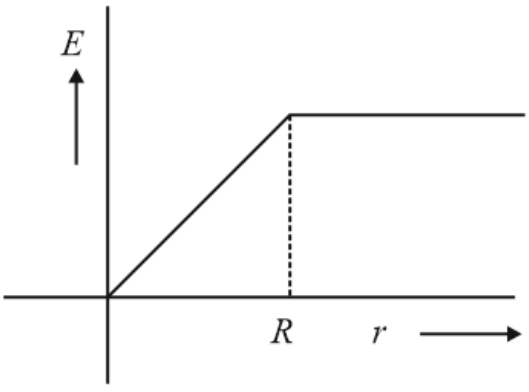
(1)



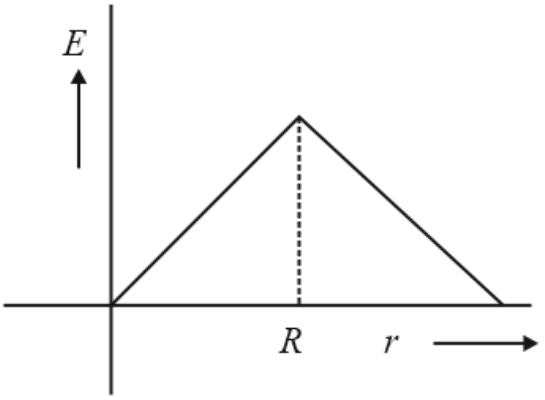
(2)



(3)



(4)



Q22. If microwaves, X-rays, infrared, gamma rays, ultraviolet, radio waves and visible parts of the electromagnetic spectrum are denoted respectively by M, X, I, G, U, R and V the following is the arrangement in ascending order of the wavelength

(1) I, M, R, U, V, X and G
(2) R, M, I, V, U, X and G
(3) M, R, V, X, U, G and I
(4) G, X, U, V, I, M and R

Q23. The diameter of the objective lens of the microscope makes an angle β at the focus of the microscope. Further, the medium between the object and the lens is the oil of the refractive index n. Then the resolving power of the microscope.

(1) Increases with decreasing value of β
(2) Increases with increasing value of $n \sin 2\beta$
(3) Increases with increasing value of $\frac{1}{n \sin 2\beta}$
(4) Increases with decreasing value of n

Q24. A ray of light is incident from a denser to a rarer medium. The critical angle for total internal reflection is θ_{iC} and Brewster's angle of incidence is θ_{iB}, such that $\frac{\sin\theta_{iC}}{\sin\theta_{iB}} = \eta = 1.28$. The relative refractive index of the two media is

(1) 0.4
(2) 0.2
(3) 0.9
(4) 0.8

Q25. In Young's double-slit experiment, the distance between the two identical slits is 6.1 times larger than the slit width. Then the number of intensity maxima observed within the central maximum of the single-slit diffraction pattern is :

(1) 3
(2) 6
(3) 24
(4) 12

Q26. Match List-I (Experiment performed) with List- II (Phenomena discovered/associated)and select the correct option from the options given below the lists

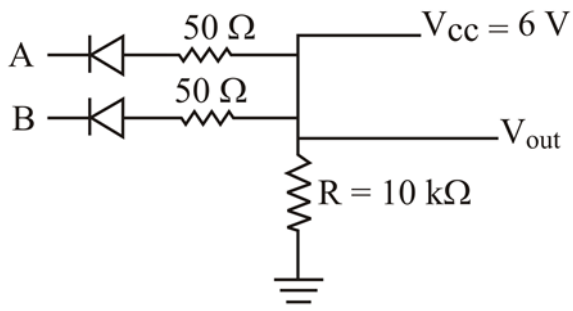
List-I	**List-II**
(a) Davisson and Germer experiment	(i) Wave nature of electrons
(b) Millikan's oil drop experiment	(ii) Charge of an electron
(c) Rutherford experiment	(iii) Quantisation of energy levels
(d) Franck-Hertz experiment	(iv) Existence of the nucleus

(1) (a)-(iii), (b)-(iv), (c)-(i), (d)-(ii)
(2) (a)-(i), (b)-(ii), (c)-(iv), (d)-(iii)
(3) (a)-(iv), (b)-(iii), (c)-(ii), (d)-(i)
(4) (a)-(i), (b)-(ii), (c)-(iii), (d)-(iv)

Q27. A piece of wood from a recently cut tree shows 20 decays per minute. A wooden piece of the same size placed in a museum (obtained from a tree cut many years back) shows 2 decays per minute. If the half-life of C^{14} is 5730 years, then the age of the wooden piece placed in the museum is approximately
[This question was awarded a bonus and proper correction was made to avoid that]

(1) 10439 years
(2) 39049 years
(3) 19042 years
(4) 13094 years

Q28.



Given, A and B are input terminals
Logic 1 is> 5 V
Logic 0 is< 1 V

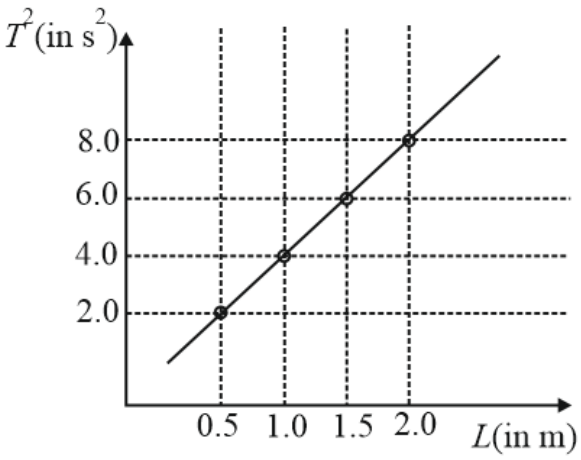
Which logic gate operation, the following circuit does?
Note: This question was awarded a bonus. *C* option changed.

(1) OR gate. (2) NOR gate.
(3) Output will always be one. (4) XOR gate.

Q29. Long-range radio transmission is possible when the radio waves are reflected from the ionosphere. For this to happen the frequency of the radio waves must be in the range:

(1) $150-500$ kHz (2) $80-150$ MHz
(3) $1-3$ MHz (4) $8-25$ MHz

Q30.



In an experiment to determine the gravitational acceleration *g* of a place with the help of a simple pendulum, the measured time period squared is plotted against the string length of the pendulum in the figure. What is the value of *g* at the place?

(1) $10.0\ \text{m s}^{-2}$ (2) $9.87\ \text{m s}^{-2}$
(3) $9.91\ \text{m s}^{-2}$ (4) $9.81\ \text{m s}^{-2}$

Q31. The ionization energy of gaseous Na atoms is 495.5 kJ mol^{-1}. The lowest possible frequency of light that ionizes a sodium atom is
$\left(\text{h}=6.626\times10^{-34}\ \text{Js},\ \text{N}_\text{A}=6.022\times10^{23}\ \text{mol}^{-1}\right)$

(1) $1.24\times10^{15}\ \text{s}^{-1}$ (2) $7.50\times10^{4}\ \text{s}^{-1}$
(3) $4.76\times10^{14}\ \text{s}^{-1}$ (4) $3.15\times10^{15}\ \text{s}^{-1}$

Q32. Which one of the following has largest ionic radius ?

(1) F^- (2) B^{3+}
(3) O^{2-} (4) Li^+

Q33. Which one of the following molecules is paramagnetic?

(1) N_2 (2) O_3
(3) CO (4) NO

Q34. Sulphur dioxide and oxygen were allowed to diffuse through a porous partition. $20\ \text{dm}^3$ of SO_2 diffuses through the porous partition in 60 seconds. The volume of O_2 in dm^3 which diffuses under the similar condition in 30 seconds will be (atomic mass of sulphur$=32$ u);

(1) 28.2 (2) 10.0
(3) 14.1 (4) 7.09

Q35. For the decomposition of the compound, represented as
$NH_2COONH_4(s) \rightleftharpoons 2NH_3(g) + CO_2(g)$
the $K_p = 2.9 \times 10^{-5}$ atm^3. If the reaction is started with 1 mole of the compound, the total pressure at equilibrium would be :
(1) 7.66×10^{-2} atm (2) 38.8×10^{-2} atm
(3) 5.82×10^{-2} atm (4) 1.94×10^{-2} atm

Q36. Zirconium phosphate $[Zr_3(PO_4)_4]$ dissociates into three zirconium cations of charge $+4$ and four phosphate anions of charge -3. If molar solubility of zirconium phosphate is denoted by s and its solubility product by K_{sp} then which of the following relationship between s and K_{sp} is correct ?
(1) $S = \{K_{sp}/6912\}^7$ (2) $S = \{K_{sp}/144\}^{1/7}$
(3) $S = \left\{K_{sp}/(6912)^{1/7}\right\}$ (4) $S = (K_{sp}/6912)^{1/7}$

Q37. How many electrons are involved in the following redox reaction ?
$Cr_2O_7^{2-} + Fe^{2+} + C_2O_4^{2-} \rightarrow Cr^{3+} + Fe^{3+} + CO_2$ (Unbalanced)
(1) 6 (2) 5
(3) 3 (4) 4

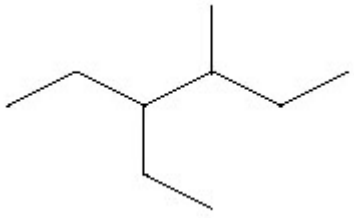
Q38. Consider the reaction :
$H_2SO_{3(aq)} + Sn^{4+}_{(aq)} + H_2O_{(l)} \rightarrow Sn^{2+}_{(aq)} + HSO^-_{4(aq)} + 3H^+_{(aq)}$
Which of the following statements is correct ?
(1) Sn^{4+} is the oxidizing agent because it undergoes oxidation (2) Sn^{4+} is the reducing agent because it undergoes oxidation
(3) H_2SO_3 is the reducing agent because it undergoes reduction (4) H_2SO_3 is the reducing agent because it undergoes oxidation

Q39. Amongst LiCl, RbCl, $BeCl_2$ and $MgCl_2$ the compounds with the greatest and the least ionic character, respectively are :
(1) $MgCl_2$ and $BeCl_2$ (2) RbCl and $MgCl_2$
(3) LiCl and RbCl (4) RbCl and $BeCl_2$

Q40. Example of a three-dimensional silicate is :
(1) Ultramarines (2) Feldspars
(3) Zeolites (4) All of these

Q41. Which of these statements is not true ?
(1) $LiAlH_4$ is versatile reducing agent in organic synthesis. (2) NO^+ is isoelectronic with O_2
(3) Boron is always covalent in its compounds (4) In aqueous solution, the Tl^+ ion is much more stable than Tl (III)

Q42. The correct IUPAC name of the following compound



is :

(1) 4 - methyl - 3 - ethylhexane
(2) 3 - ethyl - 4 - methylhexane
(3) 4 - ethyl - 3 - methylhexane
(4) 3, 4 - ethylmethylhexane

Q43. The total number of octahedral void (s) per atom present in a cubic close packed structure is :

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

Q44. For an ideal solution of two components A & B, which of the following is true?

(1) $\Delta H_{mixing} > 0$ (zero)
(2) $A - B$ interaction is stronger than $A - A$ & $B -$ B. interactions
(3) $A - A$, $B - B$ & $A - B$ interactions are identical
(4) $\Delta H_{mixing} < 0$ (zero)

Q45. The observed osmotic pressure for a 0.10 M solution of $Fe(NH_4)_2(SO_4)_2$ at $25^{\circ}C$ is 10.8 atm. The expected and experimental (observed) values of Van't Hoff factor 'i' will be respectively;
$(R = 0.082\ L\ atm\ k^{-}\ mol^{-1})$

(1) 4 and 4.00
(2) 3 and 5.42
(3) 5 and 4.42
(4) 5 and 3.42

Q46. Choose the correct statement with respect to the vapour pressure of a liquid among the following :

(1) Increases non-linearly with increasing temperature
(2) Decreases non-linearly with increasing temperature
(3) Decreases linearly with increasing temperature
(4) Increases linearly with increasing temperature

Q47. For the reaction, $3A + 2B \rightarrow C + D$, the differential rate law can be written as :

(1) $+\frac{1}{3}\frac{d[A]}{dt} = -\frac{d[C]}{dt} = k[A]^n[B]^m$
(2) $\frac{1}{3}\frac{d[A]}{dt} = \frac{d[C]}{dt} = k[A]^n[B]^m$
(3) $-\frac{1}{3}\frac{d[A]}{dt} = \frac{d[C]}{dt} = k[A]^n[B]^m$
(4) $-\frac{d[A]}{dt} = \frac{d[C]}{dt} = k[A]^n[B]^m$

Q48. Which one of the following ores is known as Malachite:

(1) Cu_2S
(2) Cu_2O
(3) $Cu(OH)_2.CuCO_3$
(4) $CuFeS_2$

Q49. An octahedral complex with molecular composition $M.5NH_3.Cl.SO_4$ has two isomers, A and B. The solution of A gives a white precipitate with $AgNO_3$ solution and the solution of B gives white precipitate with $BaCl_2$ solution .The type of isomerism exhibited by the complex is :

(1) Coordinate isomerism (2) Geometrical isomerism
(3) Ionisation isomerism (4) Linkage isomerism

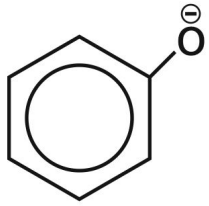
Q50. Nickel $(Z = 28)$ combines with a uninegative monodentate ligand to form a diamagnetic complex $[NiL_4]^{2-}$. The hybridisation involved and the number of unpaired electrons present in the complex are respectively:
(1) dsp^2, zero (2) sp^3, zero
(3) dsp^2,, one (4) sp^3, two

Q51. Amongst the following, identify the species with an atom in $+6$ oxidation state.
(1) CrO_2Cl_2 (2) $[Cr(CN)_6]^{3-}$
(3) Cr_2O_3 (4) $[MnO_4]^-$

Q52. The major product formed when 1, 1, 1- trichloropropane is treated with aqueous potassium hydroxide is :
(1) 2 - Propanol (2) Propyne
(3) Propionic acid (4) 1 - Propanol

Q53. Which of the following compounds will not be soluble in sodium bicarbonate?
(1) 2, 4, 6 - Trinitrophenol (2) Benzene sulphonic acid
(3) o - Nitrophenol (4) Benzoic acid

Q54. Which one of the following substituents at para-position is most effective in stabilizing the phenoxide



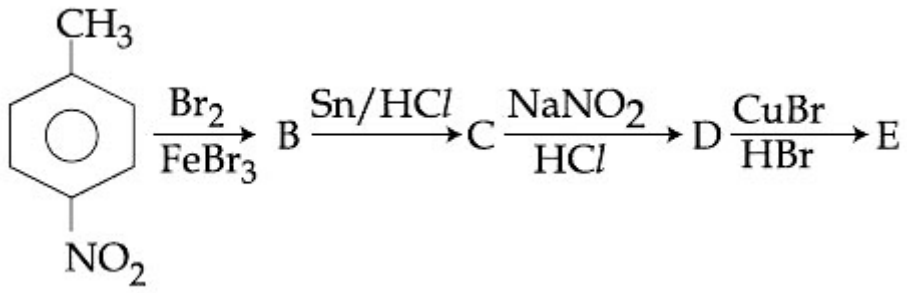
ion ?

(1) $-CH_3$ (2) $-OCH_3$
(3) $-COCH_3$ (4) $-CH_2OH$

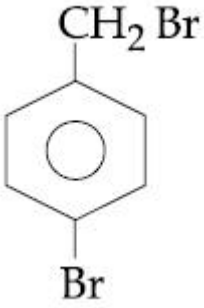
Q55. Williamson synthesis of ether is an example of :
(1) Nucleophilic substitution (2) Electrophilic addition
(3) Nucleophilic addition (4) Electrophilic substitution

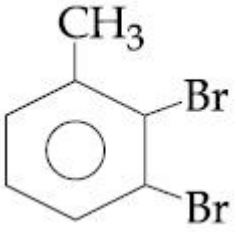
Q56. The final product formed when methylamine is treated with $NaNO_2$ and HCl followed by hydrolysis is:
(1) Nitromethane (2) Methylcyanide
(3) Methyl alcohol (4) Diazomethane

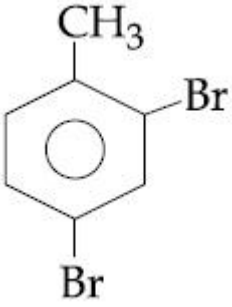
Q57. In a set of reactions p - nitrotoluene yielded a product E

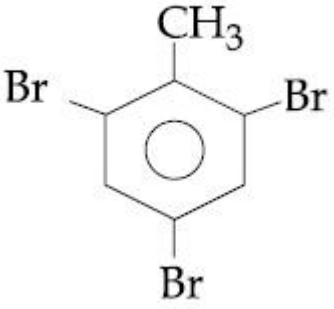


The product E would be :

(1)


(2)


(3)


(4)


Q58. Which one of the following is an example of thermosetting polymer?

(1) Nylon -6,6
(2) Bakelite
(3) Buna - N
(4) Teflon

Q59. Among the following organic acids, the acid present in rancid butter is :

(1) Pyruvic acid
(2) Acetic acid
(3) Butyric acid
(4) Lactic acid

Q60. The reason for double helical structure of DNA is the operation of :

(1) Van der Waals forces
(2) Electrostatic attractions
(3) Hydrogen bonding
(4) Dipole - Dipole interactions

Q61. The equation $\sqrt{3x^2 + x + 5} = x - 3$, where x is real, has

(1) no solution
(2) exactly four solutions
(3) exactly one solution
(4) exactly two solutions

Q62. For all complex numbers z of the form $1+i\alpha,\ \alpha \in R$, if $z^2 = x+iy$, then
(1) $y^2-4x+4=0$ (2) $y^2+4x-4=0$
(3) $y^2-4x+2=0$ (4) $y^2+4x+2=0$

Q63. Two women and some men participated in a chess tournament in which every participant played two games with each of the other participants. If the number of games that the men played between them-selves exceeds the number of games that the men played with the women by 66, then the number of men who participated in the tournament lies in the interval
(1) $(11,13]$ (2) $(14,17)$
(3) $[10,12)$ (4) $[8,9]$

Q64. Let $f(n) = \left[\frac{1}{3} + \frac{3n}{100}\right]n$, where $[n]$ denotes the greatest integer less than or equal to n. Then $\sum_{n=1}^{56} f(n)$ is equal to
(1) 56 (2) 1287
(3) 1399 (4) 689

Q65. The number of terms in an $A.P.$ is even, the sum of the odd terms in it is 24 and that the even terms is 30. If the last term exceeds the first term by $10\frac{1}{2}$, then the number of terms in the $A.P.$ is
(1) 4 (2) 8
(3) 16 (4) 12

Q66. The coefficient of x^{1012} in the expansion of $\left(1+x^n+x^{253}\right)^{10}$, (where $n \leq 22$ is any positive integer), is
(1) ${}^{253}C_4$ (2) ${}^{10}C_4$
(3) $4n$ (4) 1

Q67. If a line L is perpendicular to the line $5x-y=1$, and the area of the triangle formed by the line L and the coordinate axes is 5 sq units, then the distance of the line L from the line $x+5y=0$ is
(1) $\frac{7}{\sqrt{13}}$ units (2) $\frac{7}{\sqrt{5}}$ units
(3) $\frac{5}{\sqrt{13}}$ units (4) $\frac{5}{\sqrt{7}}$ units

Q68. The circumcentre of a triangle lies at the origin and its centroid is the midpoint of the line segment joining the points $\left(a^2+1,\ a^2+1\right)$ and $(2a\ ,\ -2\ a),\ a \neq 0$. Then for any a, the orthocentre of this triangle lies on the line
(1) $y-\left(a^2+1\right)x=0$ (2) $y-2ax=0$
(3) $y+x=0$ (4) $(a-1)^2x-(a+1)^2y=0$

Q69. The equation of the circle described on the chord $3x+y+5=0$ of the circle $x^2+y^2=16$ as the diameter is
(1) $x^2+y^2+3x+y+1=0$ (2) $x^2+y^2+3x+y-22=0$
(3) $x^2+y^2+3x+y-11=0$ (4) $x^2+y^2+3x+y-2=0$

Q70. A chord is drawn through the focus of the parabola $y^2=6x$ such that its distance from the vertex of this parabola is $\frac{\sqrt{5}}{2}$, then its slope can be
(1) $\frac{\sqrt{5}}{2}$ (2) $\frac{2}{\sqrt{3}}$
(3) $\frac{\sqrt{3}}{2}$ (4) $\frac{2}{\sqrt{5}}$

Q71. The tangent at an extremity (in the first quadrant) of the latus rectum of the hyperbola $\frac{x^2}{4}-\frac{y^2}{5}=1$, meets the x-axis and y-axis at A and B, respectively. Then OA^2-OB^2, where O is the origin, equals

(1) $-\frac{20}{9}$ (2) $\frac{16}{9}$

(3) 4 (4) $-\frac{4}{3}$

Q72. The contrapositive of the statement "if I am not feeling well, then I will go to the doctor" is

(1) if I will go to the doctor, then I am not feeling well. (2) if I am feeling well, then I will not go to the doctor.

(3) if I will not go to the doctor, then I am feeling well. (4) if I will go to the doctor, then I am feeling well.

Q73. Let $\overline{x}$, M and σ^2 be respectively the mean, mode and variance of n observations $x_1,\ x_2,\ldots,\ x_n$ and $d_i=-x_i-a,\ i=1,\ 2,\ldots,\ n$, where a is any number.

Statement I: Variance of $d_1,\ d_2,\ldots,\ d_n$ is σ^2.

Statement II: Mean and mode of $d_1,\ d_2,\ldots,\ d_n$ are $-\overline{x}-a$ and $-M-a$, respectively.

(1) **Statement I** and **Statement II** are both true (2) **Statement I** and **Statement II** are both false

(3) **Statement I** is true and **Statement II** is false (4) **Statement I** is false and **Statement II** is true

Q74. Let A and B be any two 3×3 matrices. If A is symmetric and B is skew symmetric, then the matrix $AB-BA$ is

(1) skew symmetric (2) I or $-I$, where I is an identity matrix

(3) symmetric (4) neither symmetric nor skew symmetric

Q75. If $\Delta_r=\begin{vmatrix} r & 2r-1 & 3r-2 \\ \frac{n}{2} & n-1 & a \\ \frac{1}{2}n(n-1) & (n-1)^2 & \frac{1}{2}(n-1)(3n+4) \end{vmatrix}$, then the value of $\sum_{r=1}^{n-1}\Delta_r$

(1) Is independent of both a and n (2) Depends only on a

(3) Depends only on n (4) Depends both on a and n

Q76. The principal value of $\tan^{-1}\left(cot\frac{43\pi}{4}\right)$ is

(1) $\frac{\pi}{4}$ (2) $-\frac{\pi}{4}$

(3) $\frac{3\pi}{4}$ (4) $-\frac{3\pi}{4}$

Q77. The function $f(x)=|\sin 4x|+|\cos 2x|$, is a periodic function with a fundamental period

(1) π (2) 2π

(3) $\frac{\pi}{4}$ (4) $\frac{\pi}{2}$

Q78. Let $f:\ R\to R$ be defined by $f(x)=\frac{|x|-1}{|x|+1}$, then f is

(1) one-one but not onto (2) neither one-one nor onto

(3) both one-one and onto (4) onto but not one-one

Q79. If the function $f(x)=\begin{cases}\frac{\sqrt{2+\cos x}-1}{(\pi-x)^2}, & x\neq\pi \\ k, & x=\pi\end{cases}$ is continuous at $x=\pi$, then k equals

(1) $\frac{1}{4}$ (2) 0

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

Q80. Let $f:\ R \to R$ be a function such that $|f(x)| \le x^2$, for all $x \in R$. Then, at $x = 0$, f is

(1) differentiable but not continuous
(2) neither continuous nor differentiable
(3) continuous as well as differentiable
(4) continuous but not differentiable

Q81. If the volume of a spherical ball is increasing at the rate of 4π cc / sec then the rate of increase of its radius (in cm / sec), when the volume is 288π cc is

(1) $\frac{1}{9}$
(2) $\frac{1}{6}$
(3) $\frac{1}{24}$
(4) $\frac{1}{36}$

Q82. If non-zero real numbers b and c are such that $min\ f(x) > max\ g(x)$, where $f(x) = x^2 + 2bx + 2c^2$ and $g(x) = -x^2 - 2cx + b^2,\ (x \in R)$; then $\left|\frac{c}{b}\right|$ lies in the interval

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

Q83. If m is a non-zero number and $\int \frac{x^{5m-1}+2x^{4m-1}}{\left(x^{2m}+x^m+1\right)^3}dx = f(x) + c$, then $f(x)$ is equal to

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

Q84. Let, the function F be defined as $F(x) = \int_1^x \frac{e^t}{t}dt,\ x > 0$, then the value of the integral $\int_1^x \frac{e^t}{t+a}dt$, where $a > 0$, is

(1) $e^a[F(x) - F(1+a)]$
(2) $e^{-a}[F(x+a) - F(a)]$
(3) $e^a[F(x+a) - F(1+a)]$
(4) $e^{-a}[F(x+a) - F(1+a)]$

Q85. The area of the region (in square units) above the x-axis bounded by the curve $y = \tan x,\ 0 \le x \le \frac{\pi}{2}$ and the tangent to the curve at $x = \frac{\pi}{4}$ is

(1) $\frac{1}{2}\left(\log 2 - \frac{1}{2}\right)$
(2) $\frac{1}{2}(1 + \log 2)$
(3) $\frac{1}{2}(1 - \log 2)$
(4) $\frac{1}{2}\left(\log 2 + \frac{1}{2}\right)$

Q86. If $\frac{dy}{dx} + y\tan x = \sin 2x$ and $y(0) = 1$, then $y(\pi)$ is equal to

(1) -1
(2) 5
(3) 1
(4) -5

Q87. If $\vec{x} = 3\hat{i} - 6\hat{j} - \hat{k}$, $\vec{y} = \hat{i} + 4\hat{j} - 3\hat{k}$ and $\vec{z} = 3\hat{i} - 4\hat{j} - 12\hat{k}$, then the magnitude of the projection of $\vec{x} \times \vec{y}$ on $\vec{z}$ is

(1) 14
(2) 12
(3) 15
(4) 10

Q88. If the angle between the line $2(x+1) = y = z + 4$ and the plane $2x - y + \sqrt{\lambda}z + 4 = 0$ is $\frac{\pi}{6}$, then the value of λ is

(1) $\frac{45}{7}$
(2) $\frac{135}{11}$
(3) $\frac{135}{7}$
(4) $\frac{45}{11}$

Q89. Equation of the line of the shortest distance between the lines $\frac{x}{1} = \frac{y}{-1} = \frac{z}{1}$ and $\frac{x-1}{0} = \frac{y+1}{-2} = \frac{z}{1}$ is

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

Q90. Let A and E be any two events with positive probabilities
Statement I: $P(E/A) \geq P(A/E)P(E)$.
Statement II: $P(A/E) \geq P(A \cap E)$.
(1) Both the statements are false (2) Both the statements are true
(3) Statement - **I** is false, Statement - **II** is true (4) Statement - **I** is true, Statement - **II** is false

ANSWER KEYS

1. (3)	**2.** (2)	**3.** (1)	**4.** (3)	**5.** (3)	**6.** (1)	**7.** (3)	**8.** (2)
9. (2)	**10.** (1)	**11.** (2)	**12.** (2)	**13.** (2)	**14.** (4)	**15.** (1)	**16.** (3)
17. (1)	**18.** (2)	**19.** (2)	**20.** (2)	**21.** (1)	**22.** (4)	**23.** (2)	**24.** (4)
25. (4)	**26.** (2)	**27.** (3)	**28.** (3)	**29.** (4)	**30.** (2)	**31.** (1)	**32.** (3)
33. (4)	**34.** (3)	**35.** (3)	**36.** (4)	**37.** (1)	**38.** (4)	**39.** (4)	**40.** (4)
41. (2)	**42.** (2)	**43.** (1)	**44.** (3)	**45.** (3)	**46.** (1)	**47.** (3)	**48.** (3)
49. (3)	**50.** (1)	**51.** (1)	**52.** (3)	**53.** (3)	**54.** (3)	**55.** (1)	**56.** (3)
57. (3)	**58.** (2)	**59.** (3)	**60.** (3)	**61.** (1)	**62.** (2)	**63.** (3)	**64.** (3)
65. (2)	**66.** (2)	**67.** (3)	**68.** (4)	**69.** (3)	**70.** (1)	**71.** (1)	**72.** (3)
73. (1)	**74.** (3)	**75.** (1)	**76.** (2)	**77.** (4)	**78.** (2)	**79.** (1)	**80.** (3)
81. (4)	**82.** (1)	**83.** (2)	**84.** (4)	**85.** (1)	**86.** (4)	**87.** (1)	**88.** (1)
89. (3)	**90.** (2)						