Physics

1. The velocity of a particle executing a simple harmonic motion is $13\ \text{ms}^{-1}$, when its distance from the equilibrium position (Q) is 3 m and its velocity is $12\ \text{ms}^{-1}$, when it is 5 m away from Q. The frequency of the simple harmonic motion is.

(a) $\frac{5\pi}{8}$ (b) $\frac{5}{8\pi}$
(c) $\frac{8\pi}{5}$ (d) $\frac{8}{5\pi}$

2. A uniform string of length L and mass M is fixed at both ends while it is subject to a tension T. It can vibrate at frequencies (v) given by the formula (where $n = 1, 2, 3, \ldots$)

(a) $v = \frac{n}{2}\sqrt{\frac{T}{ML}}$ (b) $v = \frac{n}{2L}\sqrt{\frac{T}{M}}$
(c) $v = \frac{1}{2n}\sqrt{\frac{T}{ML}}$ (d) $v = \frac{n}{2}\sqrt{\frac{TL}{M}}$

3. A uniform capillary tube of length l and inner radius r with its upper end sealed is submerged vertically into water. The outside pressure is p_0 and surface tension of water is γ. When a length x of the capillary is submerged into water, it is found that water levels inside and outside the capillary coincide. The value of x is.

(a) $\frac{l}{\left(1+\frac{p_0 r}{4\gamma}\right)}$ (b) $l\left(1-\frac{p_0 r}{4\gamma}\right)$
(c) $l\left(1-\frac{p_0 r}{2\gamma}\right)$ (d) $\frac{l}{\left(1+\frac{p_0 r}{2\gamma}\right)}$

4. A liquid of bulk modulus k is compressed by applying an external pressure such that its density increases by 0.01%. The pressure applied on the liquid is.

(a) $\frac{k}{10000}$ (b) $\frac{k}{1000}$
(c) $1000k$ (d). $0.01k$

5. Temperature of an ideal gas, initially at 27°C, is raised by 6°C. The rms velocity of the gas molecules will.

(a) increase by nearly 2%
(b) decrease by nearly 2%
(c) increase by nearly 1%
(d) decrease by nearly 1%

6. 2 moles of an ideal monoatomic gas is carried from a state (p_0, V_0) to state ($2p_0, 2V_0$) along a straight line path in a $p-V$ diagram. The amount of heat absorbed by the gas in the process is given by.

(a) $3p_0V_0$ (b) $\frac{9}{2}p_0V_0$
(c) $6p_0V_0$ (d) $\frac{3}{2}p_0V_0$

7. A solid rectangular sheet has two different coefficients of linear expansion α_1 and α_2 along its length and breadth respectively. The coefficient of surface expansion is. (for $\alpha_1 t \ll 1, \alpha_2 t \ll 1$)

(a) $\frac{\alpha_1+\alpha_2}{2}$ (b) $2(\alpha_1+\alpha_2)$
(c) $\frac{4\alpha_1\alpha_2}{\alpha_1+\alpha_2}$ (d) $\alpha_1+\alpha_2$

8. A positive charge Q is situated at the centre of a cube. The electric flux through any face of the cube is (in SI units).

(a) $\frac{Q}{6\varepsilon_0}$ (b) $4\pi Q$
(c) $\frac{Q}{4\pi\varepsilon_0}$ (d) $\frac{Q}{6\pi\varepsilon_0}$

9. Three capacitors of capacitance $1.0, 2.0$ and 5.0μ F are connected in series to a 10 V source. The potential difference across the 2.0μ F capacitor is.

(a) $\frac{100}{17}$ V (b) $\frac{20}{17}$ V
(c) $\frac{50}{17}$ V (d) 10 V

10. A charge of 0.8 coulomb is divided into two charges Q_1 and Q_2. These are kept at a

separation of 30 cm . The force on Q_1 is maximum when.

(a) $Q_1 = Q_2 = 0.4\text{C}$

(b) $Q_1 \approx 0.8\text{C}, Q_2$ negligible

(c) Q_1 negligible, $Q_2 \approx 0.8\text{C}$

(d) $Q_1 = 0.2\text{C}, Q_2 = 0.6\text{C}$

11. The magnetic field due to a current in a straight wire segment of length L at a point on its perpendicular bisector at a distance $r(r \gg L)$

(a) decreases as $\frac{1}{r}$

(b) decreases as $\frac{1}{r^2}$

(c) decreases as $\frac{1}{r^3}$

(d) approaches a finite limit as $r \to \infty$

12. The magnets of two suspended coil galvanometers are of the same strength so that they produce identical uniform magnetic fields in the region of the coils. The coil of the first one is in the shape of a square of side a and that of the second one is circular of radius $\frac{a}{\sqrt{\pi}}$. When the same current is passed through the coils, the ratio of the torque experienced by the first coil to that experienced by the second one is.

(a) $1:\frac{1}{\sqrt{\pi}}$ (b) $1:1$

(c) $\pi:1$ (d) $1:\pi$

13. A proton is moving with a uniform velocity of $10^6\ \text{ms}^{-1}$ along the Y-axis, under the joint action of a magnetic field along Z-axis and an electric field of magnitude $2 \times 10^4\text{Vm}^{-1}$ along the negative X-axis. If the electric field is switched off, the proton starts moving in a circle. The radius of the circle is nearly (given : $\frac{e}{m}$ ratio for proton $\approx 10^8\text{Ckg}^{-1}$).

(a) 0.5 m (b) 0.2 m

(c) 0.1 m (d) 0.05 m

14. When the frequency of the AC voltage applied to a series LCR circuit is gradually increased from a low value, the impedance of the circuit.

(a) monotonically increases

(b) first increases and then decreases

(c) first decreases and then increases

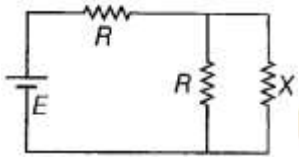
(d) monotonically decreases

15. Six wires, each of resistance r, are connected so as to form a tetrahedron. The equivalent resistance of the combination when current enters through one corner and leaves through some other corner is.

(a) r (b) $2r$

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

16. Consider the circuit shown in the figure.

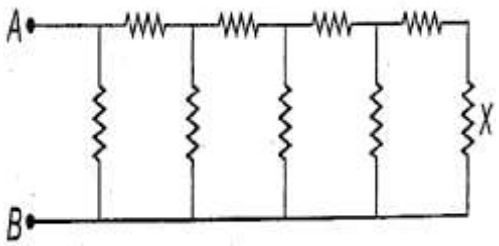


The value of the resistance X for which the thermal power generated in it is practically independent of small variation of its resistance is

(a) $X = R$ (b) $X = \frac{R}{3}$

(c) $X = \frac{R}{2}$ (d) $X = 2R$

17.



Consider the circuit shown in the figure where all the resistances are of magnitude $1\text{k}\Omega$. If the current in the extreme right resistance X is 1 mA , the potential difference between A and B is

(a) 34 V (b) 21 V
(c) 68 V (d) 55 V

18. The ratio of the diameter of the sun to the distance between the earth and the sun is approximately 0.009 . The approximate diameter of the image of the sun formed by a concave spherical mirror of radius of curvature 0.4 m is.

(a) 4.5×10^{-6} m (b) 4.0×10^{-6} m
(c) 3.6×10^{-3} m (d) 1.8×10^{-3} m

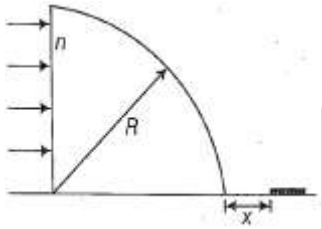
19. Two monochromatic coherent light beams A and B have intensities L and $\frac{L}{4}$, respectively. If these beams are superposed, the maximum and minimum intensities will be.

(a) $\frac{9L}{4}, \frac{L}{4}$ (b) $\frac{5L}{4}, 0$
(c) $\frac{5L}{2}, 0$ (d) $2L, \frac{L}{2}$

20. A point object is held above a thin equiconvex lens at its focus. The focal length is 0.1 m and the lens rests on a horizontal thin plane mirror. The final image will be formed at.

(a) infinite distance above the lens
(b) 0.1 m above the center of the lens
(c) infinite distance below the lens
(d) 0.1 m below the center of the lens

21.



A parallel beam of light is incident on a glass prism in the shape of a quarter cylinder of radius $R = 0.05$ m and refractive index $n = 1.5$, placed on a horizontal table as shown in the figure. Beyond the cylinder, a patch of light is found whose the nearest distance x from the cylinder is

(a) $(3\sqrt{3} - 4) \times 10^{-2}$ m
(b) $(2\sqrt{3} - 2) \times 10^{-2}$ m
(c) $(3\sqrt{5} - 5) \times 10^{-2}$ m
(d) $(3\sqrt{2} - 3) \times 10^{-2}$ m

22. The de-Broglie wavelength of an electron is 0.4×10^{-10} m when its kinetic energy is 1.0 keV Its wavelength will be 1.0×10^{-10} m, when its kinetic energy is.

(a) 0.2 keV (b) 0.8 keV
(c) 0.63 keV (d) 0.16 keV

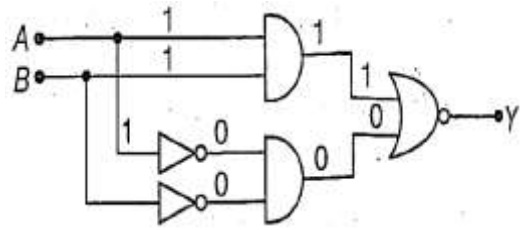
23. When light of frequency v_1 is incident on a metal with work function W (where $hv_1 > W$), then photocurrent falls to zero at a stopping potential of V_1. If the frequency of light is increased to v_2, the stopping potential changes to V_2. Therefore, the charge of an electron is given by.

(a) $\frac{W(v_2+v_1)}{v_1V_2+v_2V_1}$ (b) $\frac{W(v_2+v_1)}{v_1V_1+v_2V_2}$
(c) $\frac{W(v_2-v_1)}{v_1V_2-v_2V_1}$ (d) $\frac{W(v_2-v_1)}{v_2V_2-v_1V_1}$

24. Radon- 222 has a half-life of 3.8 days. If one starts with 0.064 kg of radon-222, the quantity of radon-222 left after 19 days will be.

(a) 0.002 kg
(b) 0.062 kg
(c) 0.032 kg
(d) 0.024 kg

25.



In the given circuit, the binary inputs at A and B are both 1 in one case and both 0 in the next case. The respective outputs at Y in these two cases will be

(a) 1,1 (b) 0,0
(c) 0, 1 (d) 1,0

26. When a semiconducting device is connected in series with a battery and a resistance, a current is found to flow in the circuit. If however, the polarity of the battery is reversed, practically no current flows in the circuit. The device may be.

(a) a p-type semiconductor
(b) a n-type semiconductor
(c) an intrinsic semiconductor
(d) a $p-n$ junction

27. The dimension of the universal constant of gravitation, G is.

(a) $[ML^2\ T^{-1}]$
(b) $[M^{-1}\ L^3\ T^{-2}]$
(c) $[M^{-1}\ L^2\ T^{-2}]$
(d) $[ML^3\ T^{-2}]$

28. Two particles A and B (both initially at rest) start moving towards each other under a mutual force of attraction. At the instant, when the speed of A is v and the speed of B is $2v$, the speed of the centre of mass is.

(a) zero (b) v
(c) $\frac{3v}{2}$ (d) $-\frac{3v}{2}$

29. Three vectors $\mathbf{A} = a\mathbf{i} + \mathbf{j} + \mathbf{k}$; $\mathbf{B} = \mathbf{i} + b\mathbf{j} + \mathbf{k}$ and $\mathbf{C} = \mathbf{i} + \mathbf{j} + c\mathbf{k}$ are mutually perpendicular ($\mathbf{i}, \mathbf{j}$ and $\mathbf{k}$ are unit vectors along X, Y and Z axes respectively). The respective values of a, b and c are.

(a) 0,0,0 (b) $-\frac{1}{2}, -\frac{1}{2}, -\frac{1}{2}$
(c) $1, -1, 1$ (d) $\frac{1}{2}, \frac{1}{2}, \frac{1}{2}$

30. A block of mass 1 kg starts from rest at $x = 0$ and moves along the X-axis under the action of a force $F = kt$, where t is time and $k = 1\text{Ns}^{-1}$. The distance the block will travel in 6 seconds is

(a) 36 m (b) 72 m
(c) 108 m (d) 18 m

31. A particle with charge Q coulomb, tied at the end of an inextensible string of length R metre, revolves in a vertical plane. At the centre of the circular trajectory, there is a fixed charge of magnitude Q coulomb. The mass of the moving charge M is such that $Mg = \frac{Q^2}{4\pi\varepsilon_0 R^2}$. If at the highest position of the particle, the tension of the string just vanishes, the horizontal velocity at the lowest point has to be.

(a) 0 (b) $2\sqrt{gR}$
(c) $\sqrt{2gR}$ (d) $\sqrt{5gR}$

32. A bullet of mass 4.2×10^{-2} kg, moving at a speed of $300\ \text{ms}^{-1}$, gets stuck into a block with a mass 9 times that of the bullet. If the block is free to move without any kind of friction, the heat generated in the process will be.

(a) 45 cal (b) 405 cal
(c) 450 cal (d) 1701 cal

33. A particle with charge e and mass m, moving along the X-axis with a uniform speed u, enters a region where a uniform electric field E is acting along the Y-axis. The particle starts to move in a parabola. Its focal length (neglecting any effect of gravity) is.

(a) $\frac{2mu^2}{eE}$ (b) $\frac{eE}{2mu^2}$
(c) $\frac{mu}{2eE}$ (d) $\frac{mu^2}{2eE}$

34. A unit negative charge with mass M resides at the mid-point of the straight line of length $2a$ adjoining two fixed charges of magnitude $+Q$ each. If it is given a very small displacement $x(x \ll a)$ in a direction perpendicular to the straight line, it will.

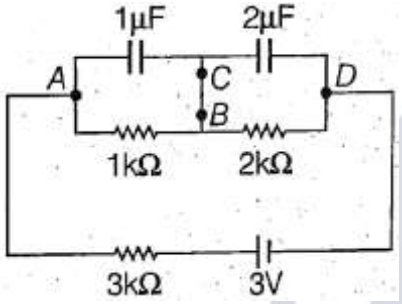
(a) come back to its original position and stay there
(b) execute oscillations with frequency.

$$\frac{1}{2\pi}\sqrt{\frac{Q}{4\pi\varepsilon_0 Ma^3}}$$

(c) fly to infinity
(d) execute oscillations with frequency

$$\frac{1}{2\pi}\sqrt{\frac{Q}{4\pi\varepsilon_0 Ma^2}}$$

35. Consider the circuit given here. The potential difference V_{BC} between the points B and C is.



(a) 1 V (b) 0.5 V
(c) 0 V (d) -1 V

36. If the pressure, temperature and density of an ideal gas are denoted by p, T and ρ, respectively, the velocity of sound in the gas is.

(a) proportional to $\sqrt{p}$, when T is constant.
(b) proportional to $\sqrt{T}$.
(c) proportional to $\sqrt{p}$, when ρ is constant.
(d) proportional to T.

37. Two long parallel wires separated by 0.1 m carry currents of 1 A and 2 A , respectively in opposite directions. A third current-carrying wire parallel to both of them is placed in the same plane such that it feels no net magnetic force. It is placed at a distance of.

(a) 0.5 m from the 1st wire, towards the 2nd wire
(b) 0.2 m from the 1st wire, towards the 2nd wire
(c) 0.1 m from the 1st wire, away from the 2nd wire
(d) 0.2 m from the 1st wire, away from the 2nd wire

38. If χ stands for the magnetic susceptibility of a substance, μ for its magnetic permeability and μ_0 for the permeability of free space, then.

(a) for a paramagnetic substance: $\chi < 0, \mu > 0$
(b) for a paramagnetic substance: $\chi > 0, \mu > \mu_0$
(c) for a diamagnetic substance: $\chi > 0, \mu < 0$
(d) for a ferromagnetic substance: $\chi > 1, \mu > \mu_0$

39. Let v_n and E_n be the respective speed and energy of an electron in the nth orbit of radius r_n, in a hydrogen atom, as predicted by Bohr's model. Then.

(a) plot of $\frac{E_n r_n}{E_1 r_1}$ as a function of n is a straight line of slope 0
(b) plot of $\frac{r_n v_n}{r_1 v_1}$ as a function of n is a straight line of slope 1

(c) plot of $\ln\left(\frac{r_n}{r_1}\right)$ as a function of $\ln(n)$ is a straight line of slope 2

(d) plot of $\ln\left(\frac{r_n E_1}{E_n r_1}\right)$ as a function of $\ln(n)$ is a straight line of slope 4

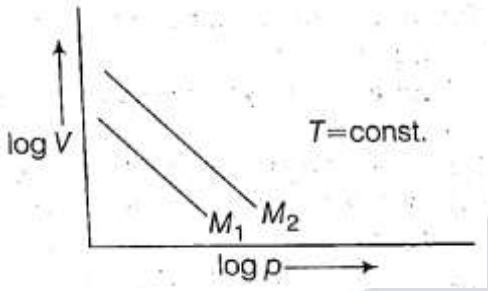
40. A small steel ball bounces on a steel plate held horizontally. On each bounce the speed of the Ball arriving at the plate is reduced by a factor e (coefficient of restitution) in the rebound, so that $V_{\text{Upward}} = eV_{\text{Downward}}$ If the ball is initially dropped from a height of 0.4 m above the plate and if 10 seconds later the bouncing ceases, the value of e is

(a) $\sqrt{\frac{2}{7}}$ (b) $\frac{3}{4}$

(c) $\frac{13}{18}$ (d) $\frac{17}{18}$

Chemistry

41.



For same mass of two different ideal gases of molecular weights M_1 and M_2, Plots of $\log V$ vs $\log p$ at a given constant temperature are shown. Identify the correct option.

(a) $M_1 > M_2$

(b) $M_1 = M_2$

(c) $M_1 < M_2$

(d) Can be predicted only if temperature is known

42. Which of the following has the dimension if [$ML^0 T^{-2}$]?

(a) Coefficient of viscosity

(b) Surface tension

(c) Vapour pressure

(d) Kinetic energy

43. If the given four electronic configurations.

(i) $n = 4, l = 1$

(ii) $n = 4, l = 0$

(iii) $n = 3, l = 2$

(iv) $n = 3, l = 1$

are arranged in order of increasing energy, then the order will be

(a) (iv) < (ii) < (iii) < (i)

(b) (ii) < (iv) < (i) < (iii)

(c) (i) < (iii) < (ii) < (iv)

(d) (iii) < (i) < (iv) < (ii)

44. Which of the following sets of quantum numbers represents the 19^{th} electron of Cr($Z = 24$) .

(a) $\left(4,1,-1,+\frac{1}{2}\right)$

(b) $\left(4,0,0,+\frac{1}{2}\right)$

(c) $\left(3,2,0,-\frac{1}{2}\right)$.

(d) $\left(3,2,-2,+\frac{1}{2}\right)$

45. 0.126 g of an acid is needed to completely neutralise 20 mL0. 1(N)NaOH solution. The equivalent weight of the acid is.

(a) 53 (b) 40

(c) 45 (d) 63

46. In a flask, the weight ratio of CH_4(g) and $SO_2(g)$ at 298 K and 1 bar is 1: 2. The ratio of

the number of molecules of $SO_2(g)$ and $CH_4(g)$ is.
(a) 1: 4 (b) 4: 1
(c) 1: 2 (d) 2: 1

47. C_6H_5 F^{18} is a F^{18} radio-isotope labelled organic compound. F^{18} decays by positron emission. The product resulting on decay is.
(a) $C_6H_5O^{18}$
(b) $C_6H_5Ar^{19}$
(c) $B^{12}C_5H_5$ F
(d) $C_6H_5O^{16}$

48. Dissolving NaCN in de-ionised water will result in a solution having.
(a) $pH < 7$ (b) $pH = 7$
(c) $pOH = 7$ (d) $pH > 7$

49. Among Me_3 N, C_5H_5 N and MeCN (Me = methyl group) the electronegativity of N is in the Order.
(a) $MeCN > C_5H_5$ N $> Me_3$ N
(b) C_5H_5 N $> Me_3$ N $>$ MeCN
(c) Me_3 N $>$ MeCN $> C_5H_5$ N
(d) Electronegativity same in all

50. The shape of XeF_5^- will be.
(a) square pyramid
(b) trigonal bipyramidal
(c) planar
(d) pentagonal bipyramid

51. The ground state magnetic property of B_2 and C_2 molecules will be.
(a) B_2 paramagnetic and C_2 diamagnetic
(b) B_2 diamagnetic and C_2 paramagnetic
(c) Both are diamagnetic
(d) Both are paramagnetic

52. The number of unpaired electrons in $[NiCl_4]^{2-}$, $Ni(CO)_4$ and $[Cu(NH_3)_4]^{2+}$ respectively are.
(a) 2, 2, 1 (b) 2, 0, 1
(c) 0,2,1 (d) 2, 2, 0

53. Which of the following atoms should have the highest I^{st} electron affinity?
(a) F (b) O
(c) N (d) C

54. $PbCl_2$ is insoluble in cold water. Addition of HCl increases its solubility due to.
(a) formation of soluble complex anions like $[PbCl_3]^-$
(b) oxidation of Pb(II) to PB(IV)
(c) formation of $[Pb(H_2O)_6]^+$
(d) formation of polymeric lead complexes

55. Of the following compounds, which one is the strongest Bronsted acid in a aqueous solution?
(a) $HClO_3$ (b) $HClO_2$
(c) HOCl (d) HOBr

56. The correct basicity order of the following lanthanide ions is.
(a) $La^{3+} > Lu^{3+} > Ce^{3+} > Eu^{3+}$
(b) $Ce^{3+} > Lu^{3+} > La^{3+} > Eu^{3+}$
(c) $Lu^{3+} > Ce^{3+} > Eu^{3+} > La^{3+}$
(d) $La^{3+} > Ce^{3+} > Eu^{3+} > Lu^{3+}$

57. When $BaCl_2$ is added to an aqueous salt solution, a white precipitate is obtained. The anion among CO_3^{2-}, SO_3^{2-} and SO_4^{2-} that was present in the solution can be.
(a) CO_3^{2-} but not any of the other two
(b) SO_3^{2-} but not any of the other two

(c) SO_4^{2-} but not any of the other two
(d) Any of them

58. In the IUPAC system, $PhCH_2CH_2CO_2H$ is named as.

(a) 3-phenylpropanoic acid
(b) benzylacetic acid
(c) carboxyethylbenzene
(d) 2-phenylpropanoic acid

59. The isomerisation of 1-butyne to 2-butyne can be achieved by treatment with

(a) hydrochloric acid
(b) ammoniacal silver nitrate
(c) ammoniacal cuprous chloride
(d) ethanolic potassium hydroxide

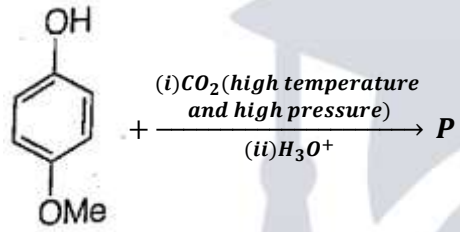
60. The correct order of acid strengths of benzoic acid (X), peroxybenzoic acid (Y) and p-nitrobenzoic acid (Z) is.

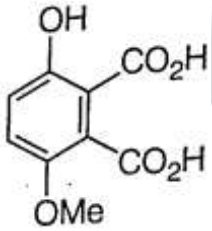
(a) $Y > Z > X$
(b) $Z > Y > X$
(c) $Z > X > Y$
(d) $Y > X > Z$

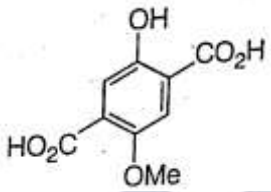
61. The yield of acetanilide in the reaction (100% conversion) of 2 moles of aniline with 1 mole of acetic anhydride is.

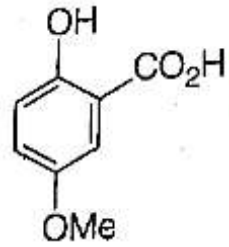
(a) 270 g (b) 135 g
(c) 67.5 g (d) 177 g

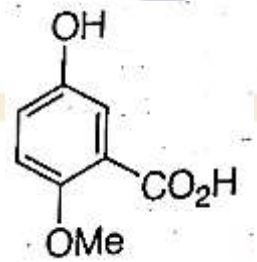
62. The structure of the product P of the following reaction is.



(a) 

(b) 

(c) 

(d) 

63. ADP and ATP differ in the number of.

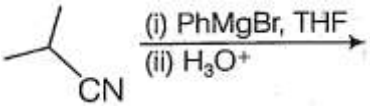
(a) phosphate units
(b) ribose units
(c) adenine base
(d) nitrogen atom

64. The compound that would produce a nauseating smell/odour with a hot mixture of chloroform and ethanolic potassium hydroxide is.

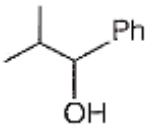
(a) $PhCONHH_2$
(b) $PhNHCH_3$

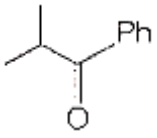
(c) $PhNH_2$
(d) PhOH

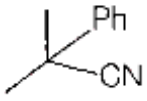
65. For the reaction below

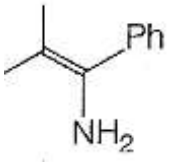


the structure of the product *Q* is.

(a) 

(b) 

(c) 

(d) 

66. You are supplied with 500 mL each of 2 N HCl and 5 N HCl . What is the maximum volume of 3 M HCl that you can prepare using only these two solutions?

(a) 250 mL (b) 500 nL
(c) 750 mL (d) 1000 mL

67. Which one of the following corresponds to a photon of highest energy?

(a) $\lambda = 300$ mm
(b) $\nu = 3 \times 10^8\ s^{-1}$
(c) $\bar{\nu} = 30\ cm^{-1}$
(d) $\varepsilon = 6.626 \times 10^{-27}$ J

68. Assuming the compounds to be completely dissociated in aqueous solution, identify the pair of the solutions that can be expected to be isotonic at the same temperature.

(a) 0.01 M urea and 0.01 M NaCl
(b) 0.02 M NaCl and $0.01MNa_2SO_4$
(c) 0.03 M NaCl and $0.02MMgCl_2$
(d) 0.01 M sucrose and 0.02 M glucose

69. How many faradays are required to reduce 1 mol of $Cr_2O_7^{2-}$ to Cr^{3+} in acid medium?

(a) 2 (b) 3
(c) 5 (d) 6

70. Equilibrium constants for the following reactions at 1200 K are given

$2H_2O(g) \rightleftharpoons 2H_2(g) + O_2(g)$,
$K_1 = 6.8 \times 10^{-8}$
$2CO_2(g) \rightleftharpoons 2CO(g) + O_2(g)$,
$K_2 = 1.6 \times 10^{-6}$

The equilibrium constant for the reaction?
$H_2(g) + CO_2(g) \rightleftharpoons CO(g) + H_2O(g)$ **at 1200 K will be**

(a) 0.05 (b) 20
(c) 0.2 (d) 5.0

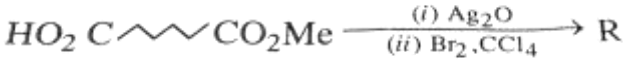
71. In a close-packed body-centred cubic lattice of potassium, the correct relation between the atomic radius (*r*) of potassium and the edge-length (a) of the cube is.

(a) $r = \frac{a}{\sqrt{2}}$ (b) $r = \frac{a}{\sqrt{3}}$
(c) $r = \frac{\sqrt{3}}{2}a$ (d) $r = \frac{\sqrt{3}}{4}a$

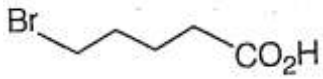
72. Which of the following solutions will turn violet when a drop of lime juice is added to it?

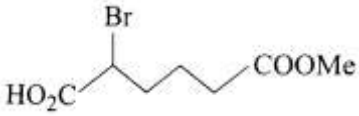
(a) A solution of NaI
(b) A solution mixture of KI and $NaIO_3$
(c) A solution mixture of NaI and KI
(d) A solution mixture of KIO_3 and $NaIO_3$

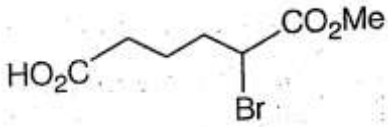
73. The reaction sequence given below given product *R*.

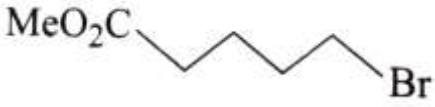


The structure of the product *R* is.

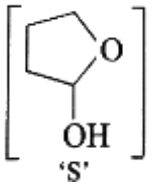
(a)


(b)


(c)


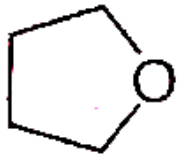
(d)


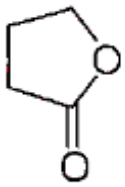
74. Reduction of the lactol *S*.

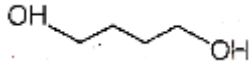


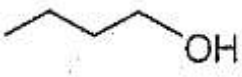
'S'

OH with sodium borohydride gives.

(a)


(b)


(c)


(d)


75. What will be the normality of the salt solution obtained by neutralising x mLy(N)HCl with y mL x(N)NaOH, and finally adding $(x + y)$mL distilled water.

(a) $\frac{2(x+y)}{xy}N$ (b) $\frac{xy}{2(x+y)}N$

(c) $\left(\frac{2xy}{x+y}\right)N$ (d) $\left(\frac{x+y}{xy}\right)N$

76. During electrolysis of molten NaCl , some water was added. What will happen?

(a) Electrolysis will stop
(b) Hydrogen will be evolved
(c) Some amount of caustic soda will be formed
(d) A fire is likely

77. The role of fluorspar, which is added in small quantities in the electrolytic reduction of alumina dissolved in fused cryolite is.

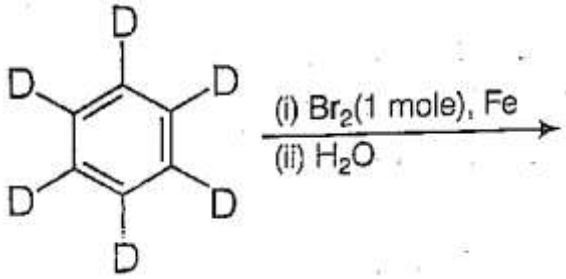
(a) as a catalyst

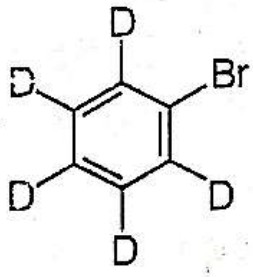
(b) to make fused mixture conducting
(c) to lower the melting temperature of the mixture
(d) to decrease the rate of oxidation of carbon at anode

78. The reduction of benzenediazonium chloride to phenyl hydrazine can be accomplished by.

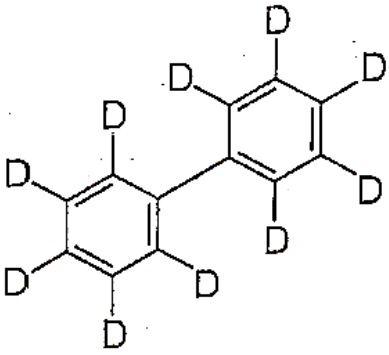
(a) $SnCl_2, HCl$
(b) Na_2SO_3
(c) CH_3CH_2OH
(d) H_3PO_2

79. The major product(s) obtained form the following reaction of 1 mole of hexadeuteriobenzene is/are

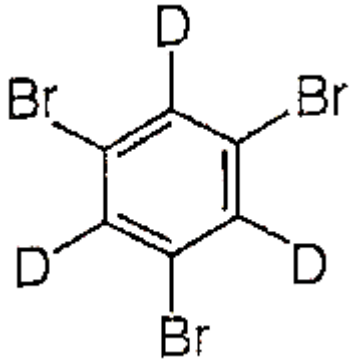




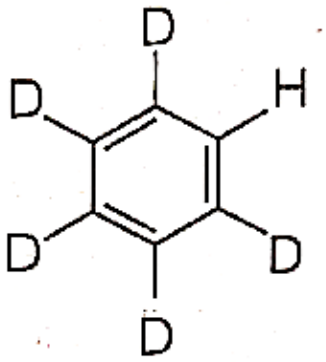
(a)



(b)

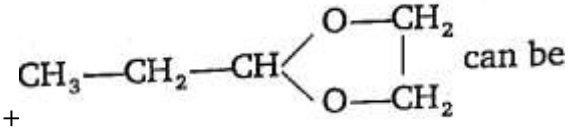


(c)



(d)

80. The conversion of $CH_3 - CH_2 - COOH$ to



+

can be accomplished by

(a) $SOCl_2$, $LiAlH_4$, ethylene glycol.
(b) $SOCl_2$, $KMnO_4$, NH_2NH_2
(c) $SnCl_2$, HCl, Na_2SO_3
(d) HCl, $SnCl_2$ ethylene glycol

MATHEMATICS

81. The number of all numbers having 5 digits, with distinct digits is

(a) 99999 (b) $9 \times {}^9P_4$
(c) ${}^{10}P_5$ (d) ${}^9P_4$

82. The greatest integer which divides $(p+1)(p+2)(p+3)\ldots(p+q)$ for all $p \in N$ and fixed $q \in N$ is.

(a) p ! (b) q !
(c) p (d) q

83. Let $(1+x+x^2)^9 = c_0 + a_1x + a_2x^2 + \cdots + a_{18}x^{18}$. Then,

(a) $a_0 + a_2 + \cdots + a_{18} = a_1 + a_3 + \cdots + a_{17}$
(b) $a_0 + a_2 + \cdots + a_{18}$ is even
(c) $a_0 + a_2 + \cdots + a_{18}$ is divisible by 9
(d) $a_0 + a_2 + \cdots + a_{18}$ is divisible by 3 but not by 9

84. The linear system of equations

$8x - 3y - 5z = 0$}
$5x - 8y + 3z = 0$} has
$3x + 5y - 8z = 0$}

(a) only zero solution
(b) only finite number of non-zero solutions
(c) no non-zero solution
(d) infinitely many non-zero solutions

85. Let P be the set of all non-singular matrices of order 3 over R and Q be the set of all orthogonal matrices of order 3 over R. Then,

(a) P is proper subset of Q
(b) Q is proper subset of P
(c) Neither P is proper subset of Q nor Q is proper subset of P
(d) $P \cap Q = \phi$, the void set

86. Let $A = \begin{pmatrix} x+2 & 3x \\ 3 & x+2 \end{pmatrix}, B = \begin{pmatrix} x & 0 \\ 5 & x+2 \end{pmatrix}$. Then all solutions of the equation $\det(AB) = 0$ is.

(a) $1, -1, 0, 2$ (b) $1, 4, 0, -2$
(c) $1, -1, 4, 3$ (d) $-1, 4, 0, 3$

87. The value of $\det A$, where

$A = \begin{pmatrix} 1 & \cos\theta & 0 \\ -\cos\theta & 1 & \cos\theta \\ -1 & -\cos\theta & 1 \end{pmatrix}$, lies

(a) in the closed interval [1,2]
(b) in the closed interval [0,1]
(c) in the open interval (0,1)
(d) in the open interval (1,2)

88. Let $f: R \to R$ be such that f is injective and $f(x)f(y) = f(x+y)$ for $\forall x, y \in R$. If $f(x)$, $f(y)$, $f(z)$ are in G.P., then x, y, z are in.

(a) AP always
(b) GP always
(c) AP depending on the value of x, y, z
(d) GP depending on the value of x, y, z

89. On the set R of real numbers we define xPy if and only if $xy \geq 0$. Then, the relation P is

(a) reflexive but not symmetric
(b) symmetric but not reflexive
(c) transitive but not reflexive
(d) reflexive and symmetric but not transitive

90. On R, the relation ρ be defined by ' $x\rho y$ holds if and only if $x - y$ is zero or irrational'. Then,

(a) ρ is reflexive and transitive but not symmetric
(b) ρ is reflexive and symmetric but not transitive
(c) ρ is symmetric and transitive but not reflexive
(d) ρ is equivalence relation

91. Mean of n observations $x_1, x_2, \ldots; x_n$ is $\bar{x}$. If an observation x_q is replaced by x_q' then the new mean is.

(a) $\bar{x} - x_q + x_q'$ (b) $\frac{(n-1)\bar{x}+x_q'}{n}$
(c) $\frac{(n-1)\bar{x}-x_q'}{n}$ (d) $\frac{n\bar{x}-x_q+x_q'}{n}$

92. The probability that a non-leap year selected at random will have 53 Sunday is.

(a) 0 (b) $1/7$
(c) $2/7$ (d) $3/7$

93. The equation $\sin x(\sin x + \cos x) = k$ has real solutions, where k is a real number. Then,

(a) $0 \leq k \leq \frac{1+\sqrt{2}}{2}$
(b) $2 - \sqrt{3} \leq k \leq 2 + \sqrt{3}$
(c) $0 \leq k \leq 2 - \sqrt{3}$
(d) $\frac{1-\sqrt{2}}{2} \leq k \leq \frac{1+\sqrt{2}}{2}$

94. The possible values of x, which satisfy the trigonometric equation $\tan^{-1}\left(\frac{x-1}{x-2}\right) + \tan^{-1}\left(\frac{x+1}{x+2}\right) = \frac{\pi}{4}$ are.

(a) $\pm\frac{1}{\sqrt{2}}$ (b) $\pm\sqrt{2}$
(c) $\pm\frac{1}{2}$ (d) ± 2

95. Transforming to parallel axes through a point (p, q), the equation $2x^2 + 3xy + 4y^2 + x + 18y + 25 = 0$ becomes $2x^2 + 3xy + 4y^2 = 1$. Then,

(a) $p = -2, q = 3$
(b) $p = 2, q = -3$
(c) $p = 3, q = -4$
(d) $p = -4, q = 3$

96. Let $A(2, -3)$ and $B(-2, 1)$ be two angular points of $\triangle ABC$. If the centroid of the triangle moves on the line $2x + 3y = 1$, then the locus of the angular point C is given by.

(a) $2x + 3y = 9$
(b) $2x - 3y = 9$

(c) $3x + 2y = 5$
(d) $3x - 2y = 3$

97. The point $P(3, 6)$ is first reflected on the line $y = x$ and then the image point Q is again reflected on the line $y = -x$ to get the image point Q'. Then, the circumcentre of the $\triangle PQQ'$ is
(a) (6,3)
(b) $(6, -3)$
(c) $(3, -6)$
(d) (0,0)

98. Let d_1 and d_2 be the lengths of the perpendiculars drawn from any point of the line $7x - 9y + 10 = 0$ upon the lines $3x + 4y = 5$ and $12x + 5y = 7$, respectively. Then,
(a) $d_1 > d_2$ (b) $d_1 = d_2$
(c) $d_1 < d_2$ (d) $d_1 = 2d_2$

99. The common chord of the circles $x^2 + y^2 - 4x - 4y = 0$ and $2x^2 + 2y^2 = 32$ subtends at the origin an angle equal to.
(a) $\frac{\pi}{3}$ (b) $\frac{\pi}{4}$
(c) $\frac{\pi}{6}$ (d) $\frac{\pi}{2}$

100. The locus of the mid-points of the chords of the circle $x^2 + y^2 + 2x - 2y - 2 = 0$, which make an angle of 90° at the centre is.
(a) $x^2 + y^2 - 2x - 2y = 0$
(b) $x^2 + y^2 - 2x + 2y = 0$
(c) $x^2 + y^2 + 2x - 2y = 0$
(d) $x^2 + y^2 + 2x - 2y - 1 = 0$

101. Let P be the foot of the perpendicular from focus S of hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ on the line $bx - ay = 0$ and let C be the centre of the hyperbola. Then, the area of the rectangle whose sides are equal to that of SP and CP is.
(a) $2ab$ (b) ab
(c) $\frac{(a^2+b^2)}{2}$ (d) $\frac{a}{b}$

102. B is an extremity of the minor axis of an ellipse whose foci are S and S'. If $\angle SBS'$ is a right angle, then the eccentricity of the ellipse is.
(a) $\frac{1}{2}$ (b) $\frac{1}{\sqrt{2}}$
(c) $\frac{2}{3}$ (d) $\frac{1}{3}$

103. The axis of the parabola $x^2 + 2xy + y^2 - 5x + 5y - 5 = 0$ is
(a) $x + y = 0$
(b) $x + y - 1 = 0$
(c) $x - y + 1 = 0$
(d) $x - y = \frac{1}{\sqrt{2}}$

104. The line segment joining the foci of the hyperbola $x^2 - y^2 + 1 = 0$ is one of the diameters of a circle. The equation of the circle is.
(a) $x^2 + y^2 = 4$
(b) $x^2 + y^2 = \sqrt{2}$
(c) $x^2 + y^2 = 2$
(d) $x^2 + y^2 = 2\sqrt{2}$

105. The equation of the plane through $(1, 2, -3)$ and $(2, -2, 1)$ and parallel to X-axis is.
(a) $y - z + 1 = 0$
(b) $y - z - 1 = 0$
(c) $y + z - 1 = 0$
(d) $y + z + 1 = 0$

106. Three lines are drawn from the origin O with direction cosines proportional to $(1, -1, 1)$, $(2, -3, 0)$ and $(1, 0, 3)$. The three lines are.
(a) not coplanar

(b) coplanar
(c) perpendicular to each other
(d) coincident

107. Consider the non-constant differentiable function f of one variable which obeys the relation $\frac{f(x)}{f(y)} = f(x-y)$. If $f'(0) = p$ and $f'(5) = q$, then $f'(-5)$ is.

(a) $\frac{p^2}{q}$ (b) $\frac{q}{p}$
(c) $\frac{p}{q}$ (d) q

108. If $f(x) = \log_5 \log_3 x$, then $f'(e)$ is equal to.

(a) $e\log_e 5$ (b) $e\log_e 3$
(c) $\frac{1}{e\log_e 5}$ (d) $\frac{1}{e\log_e 3}$

109. Let $F(x) = e^x, G(x) = e^{-x}$ and $H(x) = G\big(F(x)\big)$, where x is a real variable. Then, $\frac{dH}{dx}$ at $x = 0$ is.

(a) 1 (b) -1
(c) $-\frac{1}{e}$ (d) $-e$

110. If $f''(0) = k, k \neq 0$, then the value of $\lim_{x\to 0} \frac{2f(x)-3f(2x)+f(4x)}{x^2}$ is.

(a) k (b) $2k$
(c) $3k$ (d) $4k$

111. If $y = e^{m\sin^{-1}x}$ then $(1-x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} - ky = 0$, where k is equal to.

(a) m^2 (b) 2
(c) -1 (d) $-m^2$

112. The chord of the curve $y = x^2 + 2ax + b$, joining the points where $x = \alpha$ and $x = \beta$, is parallel to the tangent to the curve at abscissa x is equal to.

(a) $\frac{a+b}{2}$ (b) $\frac{2a+b}{3}$
(c) $\frac{2\alpha+\beta}{3}$ (d) $\frac{\alpha+\beta}{2}$

113. Let $f(x) = x^{13} + x^{11} + x^9 + x^7 + x^5 + x^3 + x + 19$. Then, $f(x) = 0$ has.

(a) 13 real roots
(b) only one positive and only two negative real roots
(c) not more than one real root
(d) has two positive and one negative real root

114. Let $f(x) = \begin{cases} \frac{x^p}{(\sin x)^q}, & \text{if } 0 < x \leq \frac{\pi}{2}, \\ 0, & \text{if } x = 0 \end{cases}$ ($p, q \in R$). Then, Lagrange's mean value theorem is applicable to $f(x)$ in closed interval $[0, x]$.

(a) for all p, q
(b) only when $p > q$
(c) only when $p < q$
(d) for no value of p, q

115. $\lim_{x\to 0}(\sin x)^{2\tan x}$ is equal to.

(a) 2 (b) 1
(c) 0 (d) does not exist

116. $\int \cos(\log x)dx = F(x) + C$, where C is an arbitrary constant. Here, $F(x)$ is equal to.

(a) $x[\cos(\log x) + \sin(\log x)]$
(b) $x[\cos(\log x) - \sin(\log x)]$
(c) $\frac{x}{2}[\cos(\log x) + \sin(\log x)]$
(d) $\frac{x}{2}[\cos(\log x) - \sin(\log x)]$

117. $\int \frac{x^2-1}{x^4+3x^2+1}dx (x > 0)$ is.

(a) $\tan^{-1}\left(x+\frac{1}{x}\right)+C$

(b) $\tan^{-1}\left(x-\frac{1}{x}\right)+C$

(c) $\log_e\left|\frac{x+\frac{1}{x}-1}{x+\frac{1}{x}+1}\right|+C$

(d) $\log_e\left|\frac{x-\frac{1}{x}-1}{x-\frac{1}{x}+1}\right|+C$

118. Let $I=\int_{10}^{19}\frac{\sin x}{1+x^8}dx$. Then,

(a) $|I|<10^{-9}$

(b) $|\mathrm{I}|<10^{-7}$

(c) $|I|<10^{-5}$

(d) $|I|>10^{-7}$

119. Let $I_1=\int_0^n[x]dx$ and $I_2=\int_0^n\{x\}dx$, where $[x]$ and $\{x\}$ are integral and fractional parts of x and $n\in N-\{1\}$. Then, I_1/I_2 is equal to.

(a) $\frac{1}{n-1}$ (b) $\frac{1}{n}$

(c) n (d) $n-1$

120. The value of $\lim_{n\to\infty}\left[\frac{n}{n^2+1^2}+\frac{n}{n^2+2^2}+\cdots+\frac{1}{2n}\right]$ is.

(a) $\frac{n\pi}{4}$ (b) $\frac{\pi}{4}$

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

121. The value of the integral $\int_0^1 e^{x^2}dx$.

(a) is less than 1

(b) is greater than 1

(c) is less than or equal to 1

(d) lies in the closed interval [1, e]

122. $\int_0^{100}e^{x-[x]}dx$ is equal to.

(a) $\frac{e^{100}-1}{100}$ (b) $\frac{e^{100}-1}{e-1}$

(c) $100(e-1)$. (d) $\frac{e-1}{100}$

123. Solution of $(x+y)^2\frac{dy}{dx}=a^2$.

(' a ' being a constant) is

(a) $\frac{(x+y)}{a}=\tan\frac{y+C}{a}$, C is an arbitrary constant

(b) $xy\doteq a\tan Cx$, C is an arbitrary constant

(c) $\frac{x}{a}=\tan\frac{y}{C}$, C is an arbitrary constant

(d) $xy=\tan(x+C)$, C is an arbitrary constant

124. The integrating factor of the first order differential equation.

$x^2(x^2-1)\frac{dy}{dx}+x(x^2+1)y=x^2-1$ is.

(a) e^x (b) $x-\frac{1}{x}$

(c) $x+\frac{1}{x}$ (d) $\frac{1}{x^2}$

125. In a GP series consisting of positive terms, each term is equal to the sum of next two terms. Then, the common ratio of this GP series is.

(a) $\sqrt{5}$ (b) $\frac{\sqrt{5}-1}{2}$

(c) $\frac{\sqrt{5}}{2}$ (d) $\frac{\sqrt{5}+1}{2}$

126. If $(\log_5 x)(\log_x 3x)(\log_{3x}y)=\log_x x^3$, then y equals.

(a) 125 (b) 25

(c) 5/3 (d) 243

127. The expression $\frac{(1+i)^n}{(1-i)^{n-2}}$ equals.

(a) $-i^{n+1}$ (b) i^{n+1}
(c) $-2i^{n+1}$ (d) 1

128. Let $z = x + iy$, where x and y are real. The points (x, y) in the $X - Y$ plane for which $\frac{z+i}{z-i}$ is purely imaginary, lie on.

(a) a straight line
(b) an ellipse
(c) a hyperbola
(d) a circle

129. If p, q are odd integers, then the roots of the equation $2px^2 + (2p + q)x + q = 0$ are.

(a) rational
(b) irrational
(c) non-real
(d) equal

130. Out of 7 consonants and 4 vowels, words are formed each having 3 consonants and 2 vowels. The number of such words that can be formed is.

(a) 210 (b) 25200
(c) 2520 (d) 302400

131. Let $A = \begin{pmatrix} 1 & 1 & 1 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{pmatrix}$. Then, for positive integer n, A^n is.

(a) $\begin{pmatrix} 1 & n & n^2 \\ 0 & n^2 & n \\ 0 & 0 & n \end{pmatrix}$

(b) $\begin{pmatrix} 1 & n & n\left(\frac{n+1}{2}\right) \\ 0 & 1 & n \\ 0 & 0 & 1 \end{pmatrix}$

(c) $\begin{pmatrix} 1 & n^2 & n \\ 0 & n & n^2 \\ 0 & 0 & n^2 \end{pmatrix}$

(d) $\begin{pmatrix} 1 & n & 2n-1 \\ 0 & \frac{n+1}{2} & n^2 \\ 0 & 0 & \frac{n+1}{2} \end{pmatrix}$

132. Let a, b, c be such that $b(a + c) \neq 0$.

If $\begin{vmatrix} a & a+1 & a-1 \\ -b & b+1 & b-1 \\ c & c-1 & c+1 \end{vmatrix}$

$+ \begin{vmatrix} a+1 & b+1 & c-1 \\ a-1 & b-1 & c+1 \\ (-1)^{n+2}a & (-1)^{n+1}b & (-1)^n c \end{vmatrix} = 0,$

then the value of n is

(a) any integer
(b) zero
(c) any even integer
(d) any odd integer

133. On set $A = \{1, 2, 3\}$, relations R and S are given by

$R = \{(1, 1), (2, 2), (3, 3), (1, 2), (2, 1)\}$
$S = \{(1, 1), (2, 2), (3, 3), (1, 3), (3, 1)\}$

Then,

(a) $R \cup S$ is an equivalence relation
(b) $R \cup S$ is reflexive and transitive but not symmetric
(c) $R \cup S$ is reflexive and symmetric but not transitive
(d) $R \cup S$ is symmetric and transitive but not reflexive

134. If one of the diameters of the curve $x^2 + y^2 - 4x - 6y + 9 = 0$ is a chord of a circle with center $(1, 1)$, the radius of this circle is.

(a) 3 (b) 2

(c) $\sqrt{2}$ (d) 1

135. Let $A(-1, 0)$ and $B(2, 0)$ be two points. A point M moves in the plane in such a way that $\angle MBA = 2\angle MAB$. Then, the point M moves along

(a) a straight line

(b) a parabola

(c) an ellipse

(d) a hyperbola

136. If $f(x) = \int_{-1}^{x} |t| dt$, then for any $x \geq 0$, $f(x)$ is equal to.

(a) $\frac{1}{2}(1 - x^2)$

(b) $1 - x^2$

(c) $\frac{1}{2}(1 + x^2)$

(d) $1 + x^2$

137. Let for all $x > 0$, $f(x) = \lim_{n \to \infty} n\left(x^{1/n} - 1\right)$, then.

(a) $f(x) + f\left(\frac{1}{x}\right) = 1$

(b) $f(xy) = f(x) + f(y)$

(c) $f(xy) = xf(y) + yf(x)$

(d) $f(xy) = xf(x) + yf(y)$

138. Let $I = \int_0^{100\pi} \sqrt{(1 - \cos 2x)} dx$, then.

(a) $I = 0$

(b) $I = 200\sqrt{2}$

(c) $I = \pi\sqrt{2}$

(d) $I = 100$

139. The area of the figure bounded by the parabolas $x = -2y^2$ and $x = 1 - 3y^2$ is.

(a) $\frac{4}{3}$ sq units

(b) $\frac{2}{3}$ sq units

(c) $\frac{3}{7}$ sq units

(d) $\frac{6}{7}$ sq units

140. Tangents are drawn to the ellipse $\frac{x^2}{9} + \frac{y^2}{5} = 1$ at the ends of both latusrectum. The area of the quadrilateral, so formed is.

(a) 27 sq units (b) $\frac{13}{2}$ sq units

(c) $\frac{15}{4}$ sq units (d) 45 sq units

141. The value of K in order that $f(x) = \sin x - \cos x - Kx + 5$ decreases for all positive real values of x is given by.

(a) $K < 1$ (b) $K \geq 1$

(c) $K > \sqrt{2}$ (d) $K < \sqrt{2}$

142. For any vector x, where $\hat{i}, \hat{j}, \hat{k}$ have their usual meanings the value of $(\mathbf{x} \times \mathbf{i})^2 + (\mathbf{x} \times \mathbf{j})^2 + (\mathbf{x} \times \mathbf{k})^2$ where $\hat{i}, \hat{j}, \hat{k}$. have their usual meanings, is equal to.

(a) $|x|^2$ (b) $2|\mathbf{x}|^2$

(c) $3|x|^2$ (d) $4|\mathbf{x}|^2$

143. If the sum of two unit vectors is a unit vector, then the magnitude of their difference is.

(a) $\sqrt{2}$ units (b) 2 units

(c) $\sqrt{3}$ units (d) $\sqrt{5}$ units

144. Let α and β be the roots of $x^2 + x + 1 = 0$. If n be a positive integer, then $\alpha^n + \beta^n$ is.

(a) $2\cos\frac{2n\pi}{3}$
(b) $2\sin\frac{2n\pi}{3}$
(c) $2\cos\frac{n\pi}{3}$
(d) $2\sin\frac{n\pi}{3}$

145. For real x, the greatest value of $\frac{x^2+2x+4}{2x^2+4x+9}$ is.

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

146. If $a, b \in \{1,2,3\}$ and the equation $ax^2+bx+1=0$ has real roots, then.

(a) $a > b$
(b) $a \leq b$
(c) number of possible ordered pairs (a, b) is 3
(d) $a < b$

147. If the tangent to $y^2=4ax$ at the point ($at^2, 2at$) where $|t|>1$ is a normal to $x^2-y^2=a^2$ at the point ($a\sec\theta, a\tan\theta$), then.

(a) $t=-\text{cosec}\theta$
(b) $t=-\sec\theta$
(c) $t=2\tan\theta$
(d) $t=2\cot\theta$

148. The focus of the conic $x^2-6x+4y+1=0$ is.

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

149. Let $f: R \to R$ be twice continuously differentiable. Let $f(0)=f(1)=f'(0)=0$. Then,

(a) $f''(x) \neq 0$ for all x
(b) $f''(c)=0$ for some $c \in R$
(c) $f''(x) \neq 0$ if $x \neq 0$
(d) $f'(x) > 0$ for all x

150. If $f(x)=x^n, n$ being a non-negative integer, then the values of n for which $f'(\alpha+\beta)=f'(\alpha)+f'(\beta)$ for all $\alpha, \beta > 0$ is.

(a) 1 (b) 2
(c) 0 (d) 5

151. Let f be a non-constant continuous function for all $x \geq 0$. Let f satisfy the relation $f(x)f(a-x)=1$ for some $a \in R^+$. Then, $I=\int_0^a \frac{dx}{1+f(x)}$ is equal to.

(a) a (b) $\frac{a}{4}$
(c) $\frac{a}{2}$ (d) $f(a)$

152. If the line $ax+by+c=0, ab \neq 0$, is a tangent to the curve $xy=1-2x$, then.

(a) $a > 0, b < 0$
(b) $a > 0, b > 0$
(c) $a < 0, b > 0$
(d) $a < 0, b < 0$

153. Two particles move in the same straight line starting at the same moment from the same point in the same direction. The first moves with constant velocity u and the second starts from rest with constant acceleration f. Then,

(a) they will be at the greatest distance at the end of time $\frac{u}{2f}$ from the start
(b) they will be at the greatest distance at the end of time $\frac{u}{f}$ from the start
(c) their greatest distance is $\frac{u^2}{2f}$
(d) their greatest distance is $\frac{u^2}{f}$

154. The complex number z satisfying the equation $|z-i|=|z+1|=1$ is.

(a) 0 (b) $1+i$
(c) $-1+i$ (d) $1-i$

155. On R, the set of real numbers, a relation ρ is defined as ' $a\rho b$ if and only if $1+ab>0$ '. Then,

(a) ρ is an equivalence relation
(b) ρ is reflexive and transitive but not symmetric
(c) ρ is reflexive and symmetric but not transitive
(d) ρ is only symmetric