MHT CET 2025 PCM Apr 21 Shift 2 Question Paper

Conducted by the State Common Entrance Test Cell, Maharashtra

Time Allowed: 180 Minutes **Total Questions: 150** **Maximum Marks: 200**

General Instructions

(i) This **PCM** paper is from **MHT CET 2025**, conducted by the **State Common Entrance Test Cell, Maharashtra**.

(ii) Answer all **150 multiple choice questions**: **50 Physics**, **50 Chemistry** and **50 Mathematics**.

(iii) Each question offers **four choices**, with **one correct answer**.

(iv) Allow **90 minutes for Physics and Chemistry together**, followed by **90 minutes for Mathematics**. The first group closes before the second opens.

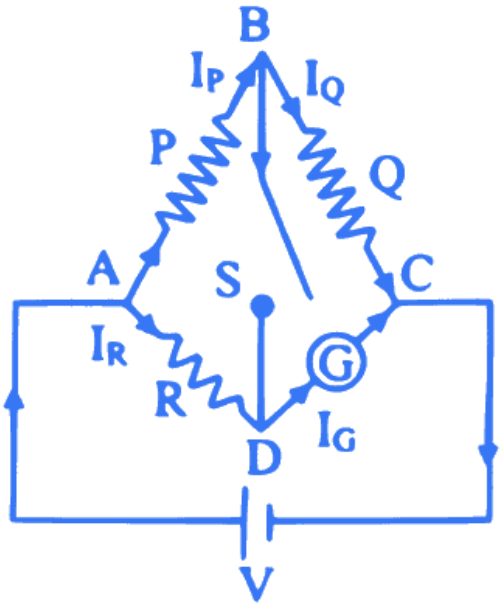
(v) Correct answers earn **1 mark in Physics and Chemistry** and **2 marks in Mathematics**.

(vi) There is **no negative marking**. Unanswered questions score zero.

1. Error in the measurement of radius of the sphere is 2%. The error in the calculated value of its volume is

(A) 3%
(B) 2%
(C) 6%
(D) 9%

2. In the circuit shown in the figure, $P \neq R$. The reading of the galvanometer remains the same with switch ' S ' open or closed. Then



(A) $I_Q = I_G$
(B) $I_Q = I_R$
(C) $I_R = I_G$
(D) $I_P = I_G$

3. A unit vector in the direction of resultant vector of $\vec{A} = -2\hat{i} + 3\hat{j} + \hat{k}$ and $\vec{B} = \hat{i} + 2\hat{j} - 4\hat{k}$ is

(A) $\frac{-3\hat{i}+\hat{j}+5\hat{k}}{\sqrt{35}}$
(B) $\frac{\hat{i}+2\hat{j}-4\hat{k}}{\sqrt{35}}$
(C) $\frac{-2\hat{i}+3\hat{j}+\hat{k}}{\sqrt{35}}$
(D) $\frac{-\hat{i}+5\hat{j}-3\hat{k}}{\sqrt{35}}$

4. The moment of inertia of a ring about an axis passing through its centre and perpendicular to its plane is I. It is rotating with angular velocity ω. Another identical ring is gently placed on it so that their centres coincide. If both the rings are rotating about the same axis then loss in kinetic energy is

(A) $\frac{I\omega^2}{16}$
(B) $\frac{I\omega^2}{8}$
(C) $\frac{I\omega^2}{4}$
(D) $\frac{I\omega^2}{2}$

5. The two coherent sources produce interference with intensity ratio ' b '. In the interference pattern, the ratio $\frac{I_{max}+I_{min}}{I_{max}-I_{min}}$ will be

(A) $\frac{1+b}{\sqrt{b}}$
(B) $\frac{1+b}{2\sqrt{b}}$
(C) $\frac{2\sqrt{b}}{1+b}$
(D) $\frac{2\sqrt{b}}{(1+b)^2}$

6. The radii of circular orbits of two satellites A and B of the earth are ' $4R$ ' and ' R ' respectively, where R is the radius of earth. If the speed of satellite B is 6 V , then the speed of satellite A will be

(A) 3 V
(B) 4 V
(C) 12 V
(D) $\frac{3}{4}$ V

7. The space within the current carrying toroid is filled with aluminium of susceptibility ' χ '. The percentage increase in the magnetic field ' B ' will be

(A) $\frac{\chi}{2} \times 100$
(B) $2\chi \times 100$
(C) $(1+\chi) \times 100$
(D) $\chi \times 100$

8. Using Bohr's quantization condition, the rotational kinetic energy in the third orbit for a diatomic molecule is ($h =$ Planck's constant, I = moment of inertia of diatomic molecule)

(A) $\frac{9h^2}{8\pi^2 I}$
(B) $\frac{3h^2}{8\pi^2 I}$
(C) $\frac{6h^2}{8\pi I}$
(D) $\frac{12h^2}{7\pi^2 I}$

9. A body is rotating about its own axis. Its rotational kinetic energy is ' x ' and its angular momentum is ' y '. Hence its moment of inertia about its own axis is

(A) $\frac{x^2}{2y}$
(B) $\frac{y^2}{2x}$
(C) $\frac{x}{2y}$
(D) $\frac{y}{2x}$

10. A ray of light travelling through rarer medium is incident at a very small angle ' i ' on a glass slab and after refraction its velocity is reduced by 20%. The angle of deviation is

(A) $\frac{i}{5}$
(B) $\frac{i}{8}$
(C) $\frac{i}{4}$
(D) $\frac{i}{2}$

11. A body starts from rest and moves with a uniform acceleration. The ratio of the distance covered by the body in the n^{th} second of its motion to the total distance travelled in n second is

(A) $\frac{2}{n^2}-\frac{1}{n}$ (B) $\frac{2}{n}-\frac{1}{n^2}$

(C) $\frac{1}{\mathrm{n}}-\frac{1}{\mathrm{n}^2}$ (D) $\frac{2}{\mathrm{n}^2}+\frac{1}{\mathrm{n}}$

12. A coil is wound on a core of rectangular crosssection. If all the linear dimensions of core are increased by a factor 3 and number of turns per unit length of coil remains same, the selfinductance increases by a factor

(A) $\frac{1}{6}$ (B) 1

(C) 3 (D) 27

13. In air, a charged soap bubble of radius R breaks into 64 small soap bubbles of equal radius r. The ratio of mechanical force per unit area of big soap bubble to that of a small bubble is

(A) 1 : 4 (B) 4 : 1

(C) 2 : 1 (D) 1 : 2

14. When photons of energies twice and thrice the work function of a metal are incident on the metal surface one after other, the maximum velocities of the photoelectrons emitted in the two cases are V_1 and V_2 respectively. The ratio $\mathrm{V}_1 : \mathrm{V}_2$ is

(A) $\sqrt{3}:\sqrt{2}$ (B) $\sqrt{2}:1$

(C) $\sqrt{3}:1$ (D) $1:\sqrt{2}$

15. According to Huygen's wave theory of light, which one of the following statements is not correct?

(A) Different colours of light are due to different wavelengths of waves.

(B) Different colours of light are due to different sizes of the corpuscles.

(C) Speed of light in denser medium is less than that in rarer medium.

(D) It can explain laws of reflection and refraction.

16. A conveyor belt is moving with constant velocity (V). Sand is being dropped on the belt at the rate of Mkg/s. The force necessary to keep the belt moving with a constant velocity Vm/s will be

(A) $\frac{MV}{2}$ N (B) 2 MV N

(C) Zero N (D) MV N

17. A coil having 9 turns carrying current produces magnetic field B_1 at the centre. Now that coil is rewounded into 3 turns carrying same current. Then magnetic field at the centre B_2 is

(A) $\frac{B_1}{9}$ (B) $9B_1$

(C) $3\ \mathrm{B}_1$ (D) $\frac{B_1}{3}$

18. Two capillary tubes of same diameter are kept vertically in two liquids whose densities are in the ratio 4 : 3. If their surface tensions are in the ratio 6 : 5, the ratio of heights $\left(\frac{h_1}{h_2}\right)$ of liquids in the two capillary tubes is (Their angle of contacts are same)

(A) $\frac{10}{7}$ (B) $\frac{9}{10}$

(C) $\frac{10}{9}$ (D) $\frac{1}{2}$

19. An ideal inductor of $\left(\frac{1}{\pi}\right)$ H is connected in series with a 300Ω resistor. If a 20 V, 200 Hz alternating source is connected across the combination, the phase difference between the voltage and current is

(A) $\tan^{-1}\left(\frac{3}{4}\right)$ (B) $\tan^{-1}\left(\frac{4}{3}\right)$

(C) $\tan^{-1}\left(\frac{5}{4}\right)$ (D) $\tan^{-1}\left(\frac{4}{5}\right)$

20. Hot water cools from 80°C to 60°C in 1 minutes. In cooling from 60°C to 50°C it will take (room temperature = 30°C)

(A) 48 s (B) 42 s

(C) 50 s (D) 45 s

21. A Carnot engine has efficiency $\frac{1}{6}$. It becomes $\frac{1}{3}$, when the temperature of sink is lowered by 57 K . The temperature of the source is

(A) 171 K (B) 399 K

(C) 342 K (D) 285 K

22. An alternating e.m.f. having voltage $\mathrm{V}=\mathrm{V}_0\sin\omega t$ is applied to a series L-C-R circuit. Given : $|X_L - X_C| = R$. The r.m.s. value of potential difference across capacitor will be

(A) $\mathrm{V_0R\omega C}$ (B) $\frac{\mathrm{V_0}}{\mathrm{R\omega C}}$

(C) $\frac{\mathrm{V_0}}{2\mathrm{R\omega C}}$ (D) $\frac{\mathrm{V_0}}{\sqrt{2}\mathrm{R\omega C}}$

23. A simple pendulum oscillates with an angular amplitude θ. If the maximum tension in the string is 4 times the minimum tension then the value of θ is

(A) $\cos^{-1}(0.75)$ (B) $\cos^{-1}(0.5)$

(C) $\sin^{-1}(0.5)$ (D) $\sin^{-1}(0.75)$

24. An electron moves in Bohr orbit. The magnetic field at the centre is proportional to

(A) n^{-2} (B) n^{-3}

(C) n^{-4} (D) n^{-5}

25. The r.m.s. speed of gas molecules at 800 K will be

(A) same as at 200 K (B) twice the value at 200 K

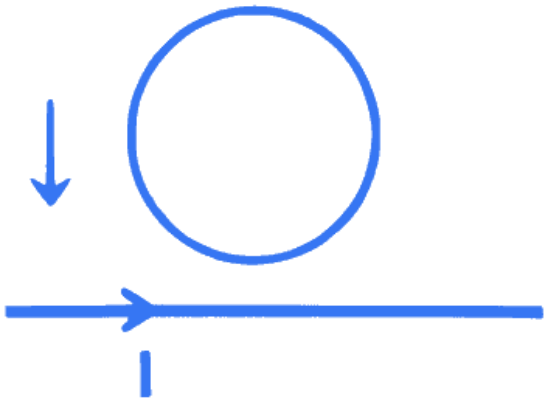
(C) four times the value at 200 K (D) half the value at 200 K

26. If the charge on the capacitor is increased by 3C, the energy stored in it increases by 21%. The original charge on the capacitor is

(A) 6 C (B) 3 C

(C) 30 C (D) 90 C

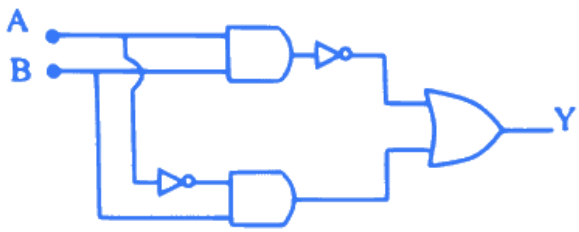
27. A conducting ring of certain resistance is falling towards a current carrying straight long conductor. The ring and conductor are in the same plane. Then



(A) induced current in the coil is zero. (B) induced current in the coil is anticlockwise.

(C) induced current in the coil is clockwise. (D) ring will come to rest.

28. In the following combination of logic gates, the output Y can be written in the terms of inputs A and B as



(A) $(A \cdot \bar{B}) + (\bar{A} \cdot B)$ (B) $(A \cdot B) + (\bar{A} \cdot B)$

(C) $(\bar{A \cdot B}) + (\bar{A} \cdot B)$ (D) $(\bar{A \cdot B}) + (A \cdot \bar{B})$

29. If a black body at 400 K surrounded by atmosphere at 300 K has rate of cooling ' R_0 ', the same body at 900 K , surrounded by same atmosphere, will have rate of cooling nearly

(A) $4R_0$ (B) $16R_0$

(C) $36R_0$ (D) $\frac{81R_0}{16}$

30. The electric field intensity on the surface of a solid charged sphere of radius **r** and volume charge density σ is ($\varepsilon_0 =$ permittivity of free space)

(A) zero (B) $\frac{5\sigma r}{6\epsilon_0}$

(C) $\frac{1}{4\pi\epsilon_0}\frac{\sigma}{r}$ (D) $\frac{\sigma r}{3\epsilon_0}$

31. Two strings ' X ' and ' Y ' of a guitar produces a beat frequency of 6 Hz . When the tension of the string ' Y ' is increased, the beat frequency is found to be 4 Hz . If the frequency of string ' X ' is 300 Hz , then the original frequency of string ' Y ' is

(A) 296 Hz (B) 294 Hz

(C) 306 Hz (D) 304 Hz

32. In common emitter mode of a transistor, the current gain is 8 . The input impedance is 25kΩ and load resistance is 75kΩ. The power gain is

(A) 192 (B) 112

(C) 316 (D) 224

33. A transverse displacement of vibrating string is $y = 0.06 \sin\left(\frac{2\pi}{3}\right) \times \cos(120\pi t)$.
If the mass per unit length of a string is 4×10^{-2} kg/m, then the tension in the string will be

(A) 1296 N (B) 1000 N

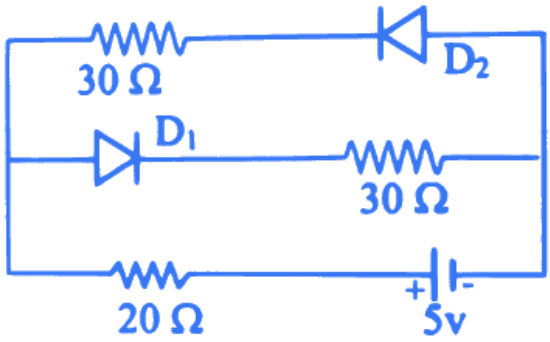
(C) 720 N (D) 500 N

34. The equation of a progressive wave is $Y = 3\sin\left[\pi\left(\frac{t}{3} - \frac{x}{5}\right) + \frac{\pi}{4}\right]$ where x and y are in meter and time in second. Which of the following is correct?

(A) Wavelength $= 10$ m (B) Velocity $= 1.5$ m/s

(C) Amplitude $= 3$ cm (D) Frequency $= 0.2$ Hz

35. If the internal resistance of cell is negligible then current flowing through the circuit is



(A) 0.04 A (B) 0.06 A

(C) 0.08 A (D) 0.10 A

36. Water flows through a horizontal pipe of varying cross-section at the rate of $\pi \times 10^{-1}$ m/s. The velocity of water at a point where the radius of the pipe is 10 cm is $(\pi = 3.14)$

(A) 0.1 m/s (B) 1 m/s

(C) 10 m/s (D) 100 m/s

37. In an electrical circuit ' R ', ' L ', ' C ' and an a.c. 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 $\frac{\pi}{3}$. If instead ' C ' is removed from the circuit, the phase difference is again $\frac{\pi}{3}$. The power factor of the circuit is $\left(\tan\frac{\pi}{3} = \sqrt{3}\right)$

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

(C) $\frac{1}{\sqrt{2}}$ (D) 1

38. A parallel plate capacitor having plate area ' A ' and separation ' d ' is charged to a potential difference ' V '. The charging battery is disconnected and the plates are pulled apart to four times the initial separation. The work required to increase the distance between the plates is ($\varepsilon_0 =$ permittivity of free space)

(A) $\frac{\epsilon_0 AV^2}{3d}$ (B) $\frac{\epsilon_0 AV^2}{4d}$

(C) $\frac{2\epsilon_0 AV^2}{d}$ (D) $\frac{3\epsilon_0 AV^2}{2d}$

39. The length of the simple pendulum is made 3 times the original length. If ' T ' is its original time period, then the new time period will be

(A) 3 T (B) $\sqrt{3}$ T

(C) $\frac{T}{\sqrt{3}}$ (D) $\frac{T}{3}$

40. A plano convex lens fits exactly in to a plano concave lens. Their plane surfaces are parallel to each other. Lenses are made up of different materials of refractive indices ' n_1 ' ' n_2 ' and ' R ' is the radius of curvature of the curved surface of lenses. Focal length of the combination is

(A) $\frac{R}{n_1+n_2}$ (B) $\frac{2R}{n_1-n_2}$

(C) $\frac{R}{2(n_1-n_2)}$ (D) $\frac{R}{n_1-n_2}$

41. Moment of inertia of a thin uniform rod rotating about the perpendicular axis passing through its centre is ' I '. If the same rod is bent in the form of ring, its moment of inertia about the diameter is ' I_1 '. If $I_1 = xI$, then the value of ' x ' is

(A) $\frac{2\pi^2}{3}$ (B) $\frac{3}{2\pi^2}$

(C) $\frac{3\pi^2}{4}$ (D) $\frac{4}{3\pi^2}$

42. If an ammeter is to be used in place of a galvanometer then we must connect

(A) low resistance in parallel. (B) high resistance in series.

(C) high resistance in parallel. (D) low resistance in series.

43. The temperature of an ideal gas is increased from 100 K to 400 K . If ' x ' is the R.M.S. velocity of its molecules at 100 K , it becomes

(A) $\frac{x}{4}$ (B) $2x$

(C) $3x$ (D) $4x$

44. What is the phase difference between the flux linked with a coil rotating in a uniform magnetic field and the induced e.m.f. produced in it?

(A) π (B) $-\frac{\pi}{6}$

(C) $\frac{\pi}{3}$ (D) $\frac{\pi}{2}$

45. A pendulum bob has a speed 4 m/s at its lowest position. The pendulum is 1 m long. When the length of the string makes an angle of 60° with the vertical, the speed of the bob at that position is (acceleration due to gravity, g $= 10$ m/s^2, $\cos 60^\circ = 0.5$)

(A) 6 m/s (B) $\sqrt{3}$ m/s

(C) $\sqrt{6}$ m/s (D) 3 m/s

46. A vehicle starts from rest and accelerates along straight path at $2\ \mathrm{m/s^2}$. At the starting point of the vehicle, there is a stationary electric siren. How far has the vehicle nearly gone when the driver hears the siren at 94% of its value when the vehicle was at rest?
(speed of sound $= 330\ \mathrm{m/s}$)

(A) 98 m
(B) 49 m
(C) 196 m
(D) 24.5 m

47. When a light of wavelength λ falls on the emitter of a photocell, maximum speed of emitted photoelectrons is V . If the incident wavelength is changed to $\frac{2\lambda}{3}$, maximum speed of emitted photoelectrons will be :

(A) $\sqrt{3}$ V
(B) $\frac{\mathrm{V}}{2}$
(C) V
(D) $\sqrt{\frac{3}{2}}$ V

48. A parallel plate capacitor has plate area $50\ \mathrm{cm^2}$ and plate separation 3 mm . The space between the plates is filled with a dielectric medium of thickness 1 mm and dielectric constant 4 . The capacitance becomes ($\varepsilon_0 =$ permittivity of free space)

(A) $\frac{18\epsilon_0}{7}$
(B) $\frac{20\epsilon_0}{9}$
(C) $\frac{16\epsilon_0}{7}$
(D) $\frac{14\epsilon_0}{5}$

49. Heat is given to an ideal gas in an isothermal process. Then
A. internal energy of the gas will decrease.
B. internal energy of the gas will increase.
C. internal energy of the gas will not change.
D. the gas will do negative work.

(A) B
(B) C
(C) D
(D) A

50. Two long parallel wires carry currents I_1 and $\mathrm{I_2}\,(\mathrm{I_1} > \mathrm{I_2})$. When currents are flowing in the same direction, the magnetic field at a point midway between the wires is 6×10^{-6} T. If the direction of $\mathrm{I_2}$ is reversed the field at midpoint becomes 3×10^{-5} T. The ratio $\mathrm{I_1} : \mathrm{I_2}$ is

(A) 3 : 2
(B) 2 : 3
(C) 3 : 5
(D) 6 : 7

51. What is IUPAC name of hydroquinone?

(A) Benzene-1,2-diol (B) Benzene-1,3-diol
(C) Benzene-1,4-diol (D) Benzene-1,3,5-triol

52. Which from following amino acids contains ' S ' in its side chain (R) ?

(A) Methionine (B) Lysine
(C) Glutamic acid (D) Glycine

53. Which from following elements forms coloured compound in its respective oxidation state?

(A) Sc^{3+} (B) Ti^{4+}
(C) Zn^{2+} (D) Cr^{3+}

54. What different types of bonds are formed by chlorine with oxygen in perchloric acid?

(A) 2-single bonds and 2-double bonds (B) 3-single bonds and 1-double bond
(C) 2-single bonds and 3-double bonds (D) 1-single bond and 3-double bonds

55. Calculate the volume of fcc unit cell in cm^3 if void volume of it is 4.16×10^{-24} cm^3.

(A) 1.3×10^{-23} (B) 1.6×10^{-23}
(C) 4.1×10^{-23} (D) 5.8×10^{-23}

56. Calculate standard enthalpy change of reaction

$$C_2H_{2(g)} + \frac{5}{2}O_{2(g)} \longrightarrow 2CO_{2(g)} + H_2O_{(l)}, \text{ if}$$
$$\Delta_f H^\circ(CO_2) = -393 \text{ kJ mol}^{-1}$$
$$\Delta_f H^\circ(H_2O) = -286 \text{ kJ mol}^{-1}$$
$$\Delta_f H^\circ(C_2H_2) = 227 \text{ kJ mol}^{-1}$$

(A) -650 kJ (B) -1950 kJ
(C) -1299 kJ (D) -2598 kJ

57. Which from following formulae is used to find the $[OH^-]$ion concentration of a weak monoacidic base?

(A) $K_b.c$ (B) $\sqrt{K_b \cdot c}$
(C) $\sqrt{\frac{K_b}{c}}$ (D) $\sqrt{K_b}$

58. Rate law for the reaction $aA + bB \rightarrow cC + dD$ is $r = k[A][B]$. Which from following conditions does NOT affect the rate of reaction?

(A) Concentration of A is doubled and concentration of B is kept constant. (B) Concentration of B is doubled and concentration of A is kept constant.
(C) Concentration of B is doubled and concentration of A is halved. (D) Concentration of A is kept constant and concentration of B is halved.

59. Identify the name of reaction of aryl halide with alkyl halide and sodium metal in dry ether to give substituted aromatic compounds.

(A) Wurtz reaction (B) Fittig reaction
(C) Wurtz-Fittig reaction (D) Friedel Crafts reaction

60. What type of arenes are obtained when arene diazonium chloride is treated with fluoroboric acid and then heated further?

(A) $Ar - NO_2$ (B) $Ar - F$
(C) $Ar - Cl$ (D) $Ar - H$

61. Identify an antiseptic compound from following.

(A) Salvarsan (B) Thymol
(C) Sulphanilamide (D) Chloromphenicol

62. If $E^\circ\left(Ag^+_{(aq)} \mid Ag_{(s)}\right) = +0.80$ V What is potential developed for $Ag_{(s)} \longrightarrow Ag^{+1}(0.01M) + e^-$ at 298 K ?

(A) +0.9184 V (B) -0.9184 V
(C) +0.6816 V (D) -0.6816 V

63. Calculate the boiling point elevation of solution if 15 g urea is dissolved in 1000 g water. [K_b for water $= 0.52$ K kg mol^{-1}; molar mass of urea $= 60$ g mol^{-1}]

(A) 0.13 K (B) 0.24 K
(C) 0.38 K (D) 0.54 K

64. Identify the product when ethylbenzene reacts with dil nitric acid.

(A) o-Nitroethylbenzene
(B) p-Nitroethylbenzene
(C) Ethoxybenzene
(D) Benzoic acid

65. Nitric oxide reacts with H_2 according to reaction, $2NO_{(g)} + 2H_{2(g)} \longrightarrow N_{2(g)} + 2H_2O_{(g)}$, identify the correct relationship among the following.

(A) $-\frac{1}{2}\frac{d[NO]}{dt} = \frac{d[H_2O]}{dt}$
(B) $-\frac{d[NO]}{dt} = \frac{d[H_2O]}{dt}$
(C) $-\frac{3}{2}\frac{d[NO]}{dt} = \frac{d[H_2O]}{dt}$
(D) $2\frac{d[H_2]}{dt} = \frac{d[N_2]}{dt}$

66. Which of the following alkanes is used for road surfacing?

(A) Alkanes with less than 10 C atoms
(B) Alkanes having 20 C to 25 C atoms
(C) Alkanes having 25 C to 30 C atoms
(D) Alkanes having more than 35 C atoms

67. Which from following compounds is obtained when acetamide is warmed with bromine and excess conc. $KOH_{(aq)}$ solution?

(A) CH_4
(B) $CH_3CH_2NH_2$
(C) CH_3COOH
(D) CH_3NH_2

68. What is the total number of moles of ' C ' atoms and ' H ' atoms respectively present in following n mole molecule?



(A) $4n$ and $2n$
(B) $4n$ and $4n$
(C) $6n$ and $14n$
(D) $6n$ and $6n$

69. Which of the following relations about E°_{cell} is false?

(A) $E^\circ_{cell} = E^\circ_{(cathode)} - E^\circ_{(anode)}$
(B) $E^\circ_{cell} = \frac{0.0592}{n} \times \log_{10} K$
(C) $E^\circ_{cell} = \frac{\Delta G^\circ}{nF}$
(D) $E^\circ_{cell} = E^\circ_{(anode)} + E^\circ_{(cathode)}$

70. Arrange the following solutions according to decreasing order of osmotic pressure under similar condition of temperature and assuming complete dissociation.

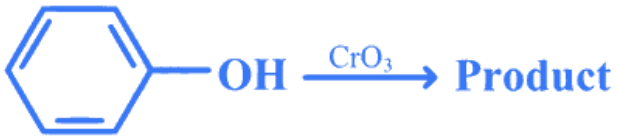
I.	0.2 mKCl
II.	0.3 $mMgSO_4$
III.	0.1 $mBaCl_2$
IV.	0.5 $mAl_2(SO_4)_3$

(A) IV > II > I > III
(B) III > IV > I > II
(C) I > III > IV > II
(D) II > III > I > IV

71. Which from following statements is NOT true about isotopes?

(A) These are the atoms of same elements.
(B) They have same chemical properties.
(C) They occupy same position in the modern periodic table.
(D) They have equal number of neutrons.

72. Identify the product in the following reaction.



(A) Benzene
(B) Benzoic acid
(C) Benzaldehyde
(D) p-Benzoquinone

73. A monobasic weak acid dissociates to 1.2% in its 0.01 M solution at 298 K . Calculate dissociation constant of it.

(A) 1.04×10^{-8}
(B) 1.44×10^{-6}
(C) 1.30×10^{-6}
(D) 1.18×10^{-5}

74. The solubility of calcium carbonate at 298 K is 6.4×10^{-5} $moldm^{-3}$. Calculate the value of solubility product at the same temperature?

(A) 5.06×10^{-10}
(B) 4.096×10^{-9}
(C) 3.05×10^{-10}
(D) 2.8×10^{-9}

75. Which from following represents the Freundlich's empirical equation for adsorption of gas on solid (for n > 1)?

(A) $\frac{x}{m} = kp^{\frac{1}{n}}$
(B) $\frac{m}{x} = kp^{\frac{1}{n}}$
(C) $\frac{x}{m} = kp^n$
(D) $\frac{m}{x} = kp^n$

76. Identify the use of glyptal.

(A) To prepare gel used in electrophoresis.
(B) To obtain paints.
(C) To obtain decorative laminates.
(D) To obtain food grade plastic container.

77. Which from following on hydrolysis forms invert sugar?

(A) Sucrose
(B) Maltose
(C) Starch
(D) Lactose

78. Which from following is the general formula of compound obtained when lanthanoid (Ln) reacts with carbon at elevated temperature?

(A) LnC
(B) LnC_2
(C) Ln_3C
(D) LnC_3

79. Identify correct statement for the reaction.

$$I_2 + KClO_3 \xrightarrow{\Delta} ICl + KIO_3$$

(A) I_2 is an oxidising agent
(B) $KClO_3$ is reducing agent
(C) Oxidation number of ' Cl' decreases by 6
(D) Oxidation number of I increases by 2

80. Calculate the number of atoms present per unit cell if product of density and volume of unit cell is 1.8×10^{-22} g.
[Mass of an atom $= 4.5 \times 10^{-23}$ g]

(A) 1
(B) 2
(C) 4
(D) 6

81. Calculate the change in internal energy of the system if 25 kJ of work done by the system and it absorbs 10 kJ of heat.

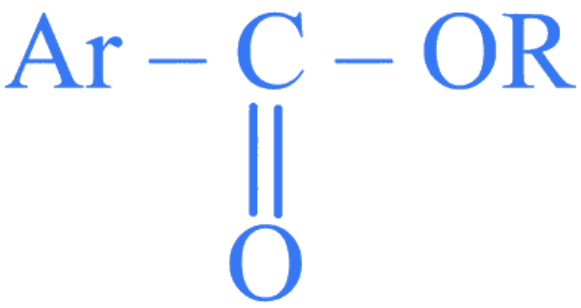
(A) -10 kJ
(B) -35 kJ
(C) -15 kJ
(D) -25 kJ

82. Identify ' Z ' in the following reaction.

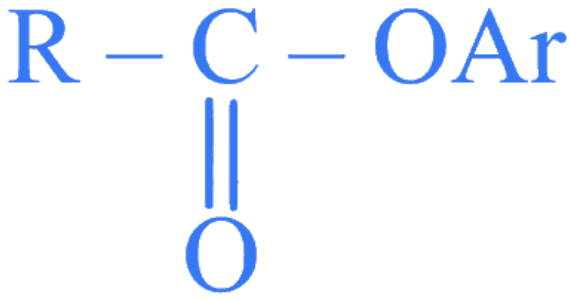


(A) Ar-O-R

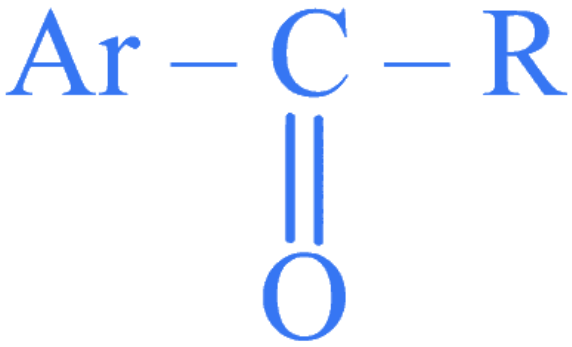
(B)



(C)



(D)



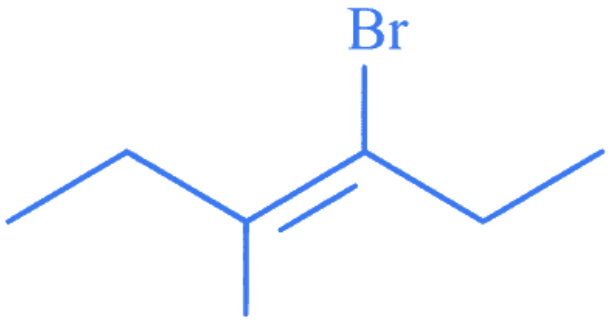
83. What is the number of electrons transferred considering Mn when $KMnO_4$ is converted into Mn_2O_3 ?

(A) 1
(B) 3
(C) 4
(D) 5

84. Identify sequential reactions involved in Sol-Gel process.

(A) Poly condensation and hydrolysis
(B) Hydrolysis and poly condensation
(C) Poly condensation and oxidation
(D) Oxidation and hydrolysis

85. What is IUPAC name of following compound?



(A) 3-Bromo-4-ethylbut-3-ene
(B) 3-Bromo-4-methylhex-3ene
(C) 4-Bromo-3-methylhex-3-ene
(D) 4-Bromo-4-ethyl-3-methylbut-3-ene

86. What is the number of moles of silver chloride precipitated when excess silver nitrate is treated with one mole of pentaamminecarbonatocobalt (III) chloride?

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

87. The mass of $4.48 dm^3$ of certain gas is 5.6 g at STP. Assuming ideal behaviour, identify the probable gas from following.

(A) Cl_2
(B) O_2
(C) N_2
(D) CH_4

88. Identify the defect developed when an ion of an ionic compound is missing from its regular site and occupies interstitial position between lattice points.

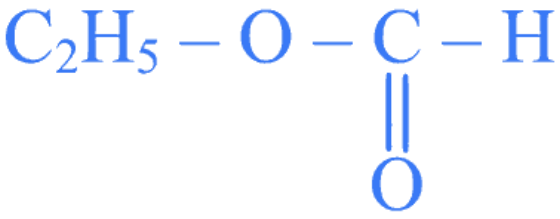
(A) Schottky defect
(B) Frenkel defect
(C) Substitutional impurity defect
(D) Interstitial impurity defect

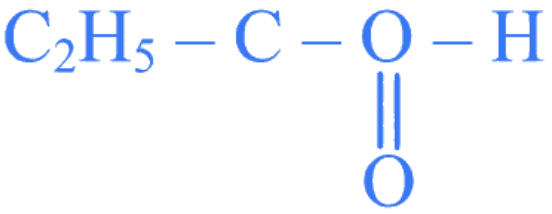
89. Identify from following an example of intensive property?

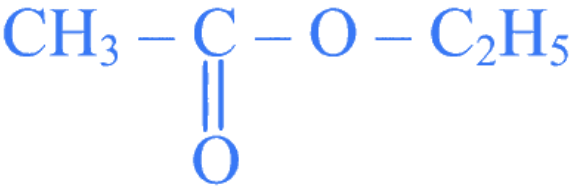
(A) Surface tension
(B) Volume
(C) Internal energy
(D) Number of moles

90. Methyl propanoate on hydrolysis with dil NaOH forms a salt that on further acidification with conc. HCl forms

(A) $CH_3 - COOH$

(B) 

(C) 

(D) 

91. Which from following elements form superoxide with air?

(A) Li
(B) Na
(C) K
(D) Mg

92. Identify a copolymer from following.

(A) Buna-S
(B) Polyacrylonitrile
(C) Polypropene
(D) Nylon 6,6

93. Calculate the number of Ca^{2+} ion in 222 g anhydrous calcium chloride? (At. Mass $Ca = 40, Cl = 35.5$)

(A) N_A
(B) $2\ N_A$
(C) $3\ N_A$
(D) $4\ N_A$

94. For a reaction, $A \longrightarrow B$, rate equation is $r = k[A]^{\circ}$. If initial concentration of reactant is 'a'-mol dm^{-3} find half life time of reaction.

(A) $\frac{a}{4k}$
(B) $\frac{a}{k}$
(C) $\frac{5a}{2k}$
(D) $\frac{a}{2k}$

95. Which of the following compounds is formed as major product in the following reaction.

2-Methylbut-2-ene $\xrightarrow[\text{Peroxide}]{\text{HBr}}$ Product

(A) 3-Bromo-2-methylbutane
(B) 2-Bromo-2-methylbutane
(C) 2-Bromo-3-methylbutane
(D) 2-Bromobutane

96. Which from following cations forms least stable complex with same ligand?

(A) Co^{2+}
(B) Fe^{2+}
(C) Cd^{2+}
(D) Cu^{2+}

97. Which of the following species is not tetrahedral?

(A) CH_4
(B) SF_4
(C) $\overset{+}{N}H_4$
(D) $SiCl_4$

98. For cell reaction,

$$2Al_{(s)} + 3Cu^{+2}_{(aq)} \longrightarrow 2Al^{+3}_{(aq)} + 3Cu_{(s)}$$

If $\Delta G^\circ = -1158$ kJ, what is E°_{cell} ?

(A) 3 V
(B) 2 V
(C) 2.5 V
(D) 1.5 V

99. Calculate the relative lowering of vapour pressure of solution containing 0.56 g nonvolatile solute in 100 g water [molar mass of solute $= 60$ g mol^{-1}]

(A) 0.0024
(B) 0.0120
(C) 0.0017
(D) 0.0221

100. Which among the following has highest boiling point?

(A) Propanone
(B) Propan-1-ol
(C) Ethanoic acid
(D) Propanal

101. Numbers are selected at random, one at a time from the two-digit numbers $00, 01, 02, - - - - - - - -, 99$ with replacement. An event E occurs only if the product of the two digits of a selected number is 24. If four numbers are selected, then probability, that the event E occurs at least 3 times, is

(A) $\frac{24}{(25)^4}$ (B) $\frac{4}{(25)^4}$

(C) $\frac{97}{(25)^4}$ (D) $\frac{96}{(25)^4}$

102. A particular solution of $3e^x \tan y \, dx + (1 - e^x) \sec^2 y \, dy = 0$ with $y(1) = \frac{\pi}{4}$ is

(A) $\tan y = (\frac{1-e^3}{1-e^x})^3$ (B) $\tan y = (\frac{1-e^2}{1-e^x})^3$

(C) $\tan y = (\frac{1-e}{1-e^x})^3$ (D) $\tan y = (\frac{1-e^x}{1-e})^3$

103. $\overline{a}, \overline{b}, \overline{c}$ are nonzero vectors such that $\overline{a}$ is perpendicular to $\overline{b}$ and $\overline{c}, |\overline{a}| = 1, |\overline{b}| = 2, |\overline{c}| = 1$ and $\overline{b} \cdot \overline{c} = 1$. There is nonzero vector $\overline{d}$ coplanar with $\overline{a} + \overline{b}$ and $2\overline{b} - \overline{c}$. If $\overline{d} \cdot \overline{a} = 1$, then $|\overline{d}|^2 =$

(A) $13y^2 + 14y + 5$ (B) $y^2 + 14y + 5$

(C) $y^2 - 14y - 5$ (D) $y^2 - 14y + 5$

104. If $\sin^{-1} x + \sin^{-1} y = \frac{\pi}{3}$ and $\cot^{-1}\left(\frac{1}{x}\right) - \cot^{-1}\left(\frac{1}{y}\right) = 0$ then $2x^2 + y^2 - xy =$

(A) $\frac{1}{4}$ (B) 1

(C) $\frac{1}{2}$ (D) 0

105. The value of $\sin\left[\tan^{-1}\left(\frac{1-x^2}{2x}\right) + \cos^{-1}\left(\frac{1-x^2}{1+x^2}\right)\right]$ is

(A) 0 (B) 1

(C) -1 (D) $\frac{1}{2}$

106. The area of the region bounded by the curve $y = |x - 2|$ between $x = 1, x = 3$ and X - axis is ……

(A) 1 sq.units (B) 2 sq.units

(C) 3 sq.units (D) 4 sq.units

107. $\int_{-1}^{3} \left(\tan^{-1}\left(\frac{x}{x^2+1}\right) + \tan^{-1}\left(\frac{x^2+1}{x}\right)\right) dx =$

(A) $\frac{\pi}{2}$ (B) π

(C) $\frac{2\pi}{3}$ (D) 2π

108. Let A be a non-singular matrix of order n and $|A| = k$, then $(\text{adj } A)^{-1}$ is

(A) $\frac{A}{k}$ (B) $k^{n-1}(\text{adj A})$

(C) k^{n-2} A (D) kA

109. If $f(x) = \begin{cases} \frac{8^x - 4^x - 2^x + 1^x}{x^2}, & \text{if } x > 0 \\ e^x \sin x + ix + \lambda \log 4, & \text{if } x \leqslant 0, i \in \mathbb{R} \end{cases}$ continuous at $x = 0$, then the value of $500e^{\lambda}$ is

(A) 1000 (B) 2000

(C) 4000 (D) 3000

110. If $\sqrt{\log_3 x^{16}} + 9\log_{27} \sqrt[3]{\frac{3}{x}} = 5$, then $x = \ldots$.

(A) 81 (B) $\frac{1}{405}$

(C) 27 (D) 405

111. The line passing through the point $(5, 1, a)$ and $(3, b, 1)$ crosses the yz-plane at $(0, \frac{17}{2}, \frac{-13}{2})$, then the value of $2a + 3b$ is

(A) 10 (B) 12

(C) 22 (D) 24

112. The direction ratios of the line of intersection of the planes $x - y + z - 5 = 0$ and $x - 3y - 6 = 0$, are

(A) $1, -1, 1$ (B) $1, -3, 0$

(C) $3, 1, -2$ (D) $1, 2, 0$

113. The distance between the line $\overline{r} = 3\hat{i} - 2\hat{j} + \hat{k} + \lambda(\hat{i} - 2\hat{j})$ and the plane $\overline{r} \cdot (2\hat{i} + \hat{j} + \hat{k}) = 4$ is

(A) $\frac{1}{\sqrt{6}}$ units (B) $\frac{3}{\sqrt{6}}$ units

(C) $\frac{2}{\sqrt{6}}$ units (D) $\frac{5}{\sqrt{6}}$ units

114. If $y = \sin^2\left(\cot^{-1}\left(\sqrt{\frac{1-x}{1+x}}\right)\right)$, then $\frac{dy}{dx} =$

(A) -1 (B) 1

(C) $-\frac{1}{4}$ (D) $\frac{1}{2}$

115.

$$\int \frac{\sin x}{\sqrt{5\sin^2 x + 6\cos^2 x}}dx$$

(A) $\log(\cos x + \sqrt{\cos^2 x + 5}\ ) + c$, where c is the constant of integration

(B) $\log(\sin x + \sqrt{6\cos^2 x + 5}) + c$, where c is the constant of integration

(C) $-\log(\cos x + \sqrt{\cos^2 x + 6}) + c$, where c is the constant of integration

(D) $-\log(\cos x + \sqrt{\cos^2 x + 5}) + c$, where c is the constant of integration

116. If $f(x) = \frac{k\sin x + 2\cos x}{\sin x + \cos x}$ is strictly increasing for all real values of x, then

(A) $k = 1$ (B) $k > 1$

(C) $k < 2$ (D) $k > 2$

117. The locus of the points represented by $|z + 3| - |z - 3| = 6$, where z is a complex number, is ....

(A) Circle with radius 1 unit (B) Straight line with slope 1.

(C) Parabola with focus $(1, 0)$ (D) X -axis

118. The locus of point of intersection of the tangents to the circle $x^2 + y^2 = 16$, such that the angle between them is 60°, is

(A) $x^2 + y^2 = 4$ (B) $x^2 + y^2 = 64$

(C) $x^2 + y^2 = 32$ (D) $x^2 + y^2 = 48$

119. A random variable, X has p.m.f. $P(X = x) = \frac{^4C_x}{2^4}, x = 0, 1, 2, 3, 4$ and μ and σ^2 are mean and variance respectively of random variable X , then

(A) $\mu = 2, \sigma^2 = 4$ (B) $\mu = 2, \sigma^2 = 1$

(C) $\mu = 3, \sigma^2 = 4$ (D) $\mu = 2, \sigma^2 = 5$

120.

The c.d.f. of a discrete random variable X is

X	−3	−1	0	1	3	5	7	9
F(X = x)	0.1	0.3	0.5	0.65	0.75	0.85	0.90	1

Then $\frac{P[X=-3]}{P[X<0]} =$

(A) $\frac{1}{4}$ (B) $\frac{1}{3}$

(C) $\frac{1}{6}$ (D) $\frac{1}{7}$

121. The distance between the lines represented by $16x^2 + 9y^2 + 48x - 24xy - 36y + 35 = 0$ is ..... units

(A) $\frac{2}{5}$ (B) $\frac{35}{2}$

(C) $\frac{5}{2}$ (D) $\frac{7}{5}$

122. The value of $\tan 20^\circ \tan 80^\circ \cot 50^\circ =$

(A) $\sqrt{3}$ (B) $\frac{1}{\sqrt{3}}$

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

123. The equation of the curve passing through the origin and satisfying the equation $(1 + x^2)\frac{dy}{dx} + 2xy = 4x^2$, is

(A) $3(1 + x^2)y = 4x^3$ (B) $3(1 - x^2)y = 4x^3$

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

124. The value of $m \in \mathbb{R}$, when angle between the vectors $\overline{p} = m\hat{i} - 6\hat{j} + 3\hat{k}$ and $\overline{q} = \hat{i} + 2\hat{j} + 2m\hat{k}$ is obtuse angle, is

(A) $m < -\frac{4}{2}$ (B) $m = 0$

(C) $m > 0$ (D) $-\frac{4}{3} < m < 0$

125. The volume of the tetrahedron whose coterminous edges are represented by $\overline{a} = -12\hat{i} + p\hat{k}, \overline{b} = 3\hat{j} - \hat{k}, \overline{c} = 2\hat{i} + \hat{j} - 15\hat{k}$ 570 cu. units, then p =

(A) 7 (B) -12

(C) -482 (D) 482

126. With usual notations, the perimeter of a triangle ABC is 6 times the arithmetic mean of sine of its angles. If $a = 1$, then $\angle A =$

(A) $\frac{\pi}{6}$ (B) $\frac{\pi}{3}$

(C) $\frac{\pi}{2}$ (D) $\frac{2\pi}{3}$

127. The angle between the lines whose direction cosines are $\frac{-\sqrt{3}}{4}, \frac{1}{4}, \frac{-\sqrt{3}}{2}$ and $\frac{-\sqrt{3}}{4}, \frac{1}{4}, \frac{\sqrt{3}}{2}$ is

(A) 90° (B) 120°

(C) 45° (D) 30°

128. If $\sin\left(\frac{\pi}{4}\cot\theta\right) = \cos\left(\frac{\pi}{4}\tan\theta\right)$, then the general solution of θ is

(A) $n\pi + \frac{\pi}{4}, n \in \mathbb{Z}$

(B) $n\pi + (-1)^n\frac{\pi}{6}, n \in \mathbb{Z}$

(C) $2n\pi \pm \frac{\pi}{4}, n \in \mathbb{Z}$

(D) $2n\pi \pm 3\frac{\pi}{4}, n \in \mathbb{Z}$

129. The differential equation of all circles having their centres on the line $y = 5$ and touching (X -axis) is

(A) $(5-y)\frac{dy}{dx} + y^2 - 10y = 0$

(B) $(5-y)^2\frac{d^2y}{dx^2} + y^2 - 10y = 0$

(C) $(5-y)\frac{dy}{dx} + y - 10 = 0$

(D) $(5-y)^2(\frac{dy}{dx})^2 + y^2 - 10y = 0$

130.

$$\int_0^{\frac{\pi}{4}} \frac{\cos^2 x \sin^2 x}{\left(\cos^3 x + \sin^3 x\right)^2} dx =$$

(A) $\frac{1}{3}$ (B) $\frac{-1}{3}$

(C) $\frac{1}{6}$ (D) $\frac{-1}{6}$

131. If $\{(p \wedge \sim q) \wedge (p \wedge r)\} \rightarrow \sim p \vee q$ has truth value false then truth values of the statements p, q, r are respectively

(A) T, T, T (B) F, F, F

(C) F, F, T (D) T, F, T

132. In a triangle ABC , with usual notations, $\tan\left(\frac{A}{2}\right) = \frac{5}{6}, \tan\left(\frac{C}{2}\right) = \frac{2}{5}$, then

(A) a, c, b are in A.P. (B) b, a, c are in A.P.

(C) a, b, c are in A.P. (D) a, b, c are in G.P.

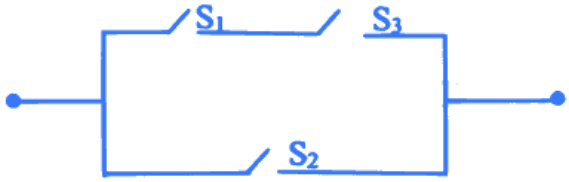
133. If ${}^{n+4}C_{n+1} - {}^{n+3}C_n = 15(n+2)$, then $n =$

(A) 15 (B) 23

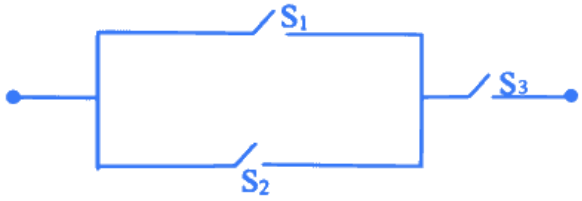
(C) 21 (D) 27

134. The correct simplified circuit diagram for the logical statement $[\{q \wedge (\sim q \vee r)\} \wedge \{\sim p \vee (p \wedge \sim r)\}] \vee (p \wedge r)$ Where p, q, r represents switches s_1, s_2, s_3 respectively.

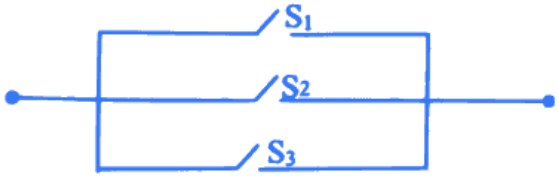
(A)



(B)



(C)



(D)



135.

$$\lim_{n \to \infty}\left[\frac{1}{1-n^4} + \frac{8}{1-n^4} + \ldots\ldots\ldots\ldots \cdot + \frac{n^3}{1-n^4}\right] =$$

(A) $\frac{1}{4}$ (B) $\frac{1}{2}$

(C) $-\frac{1}{2}$ (D) $-\frac{1}{4}$

136. If $f(\theta) = \cos\theta_1 \cdot \cos\theta_2 \cdot \cos\theta_3$ ..... $\cos\theta_n$, then $\tan\theta_1 + \tan\theta_2 + \tan\theta_3 +$. ..... $+ \tan\theta_n =$

(A) $\frac{-f'(\theta)}{f(\theta)}$ (B) $\frac{f'(\theta)}{f(\theta)}$

(C) $\frac{-f''(\theta)}{f'(\theta)}$ (D) $\frac{f''(\theta)}{f'(\theta)}$

137. The length of the altitude through the point D of tetrahedron where the vertices of the tetrahedron are $A(2,3,1), B(4,1,-2), C(6,3,7), D(-5,-4,8)$, is

(A) 5.5 units (B) 22 units

(C) 33 units (D) 11 units

138. The angle between the lines $\frac{x-1}{l}=\frac{y+1}{m}=\frac{z}{n}$ and $\frac{x+1}{\mathrm{m}}=\frac{y-3}{\mathrm{n}}=\frac{z-1}{l}$, where $l>\mathrm{m}>\mathrm{n}$ and $1, \mathrm{m}, \mathrm{n}$ are roots of the equation $x^3+x^2-4x-4=0$, is

(A) $\cos^{-1}(\frac{2}{9})$ (B) $\cos^{-1}(\frac{-4}{9})$

(C) $\cos^{-1}(\frac{2}{3})$ (D) $\cos^{-1}(\frac{1}{9})$

139. The distance of the point $\mathrm{P}(3,8,2)$ from the line $\frac{x-1}{2}=\frac{y-3}{4}=\frac{z-2}{3}$ measured parallel to the plane $3x+2y-2z+15=0$ is

(A) 7 units (B) 6 units

(C) 8 units (D) 10 units

140. The solution set for minimizing the function $\mathrm{z}=x+y$ with constraints $x+y\geqslant 2, x+2y\leqslant 8, y\leqslant 3, x, y\geqslant 0$ contains

(A) $x=0, y=3$ (B) $x=8, y=0$

(C) infinitely many points (D) $x=2, y=3$

141. The abscissae of the points of the curve $y=x^3$ are in the interval $[-2,2]$, where the slope of the tangents can be obtained by mean value theorem for the interval $[-2,2]$ are

(A) 0 (B) $\pm\sqrt{3}$

(C) $\pm\frac{2}{\sqrt{3}}$ (D) $\frac{\sqrt{3}}{2}$

142. Let x be the length of each of the equal sides of an isosceles triangle and θ be the angle between these sides. If x is increasing at the rate $\frac{1}{12}$ m/ hour and θ is increasing at the rate $\frac{\pi}{180}$rad/ hour, then the rate at which area of the triangle is increasing when $x=12$ m and $\theta=\frac{\pi}{4}$ is

(A) $(\frac{\pi}{5}+\frac{1}{2})\mathrm{m}^2/$ hour (B) $\sqrt{2}(\frac{\pi}{5}+\frac{1}{2})\mathrm{m}^2/$ hour

(C) $2(\frac{\pi}{5}+\frac{1}{2})\mathrm{m}^2/$ hour (D) $\sqrt{3}(\frac{\pi}{5}+\frac{1}{2})\mathrm{m}^2/$ hour

143.

$$\int \cos\left(\frac{x}{16}\right)\cdot\cos\left(\frac{x}{8}\right)\cdot\cos\left(\frac{x}{4}\right)\cdot\sin\left(\frac{x}{16}\right)\mathrm{d}x=$$

(A) $\frac{\cos 16x}{256}+\mathrm{c}$, where c is the constant of integration (B) $\frac{-\cos 16x}{256}+c$, where c is the constant of integration

(C) $\frac{\sin 16x}{256}+c$, where c is the constant of integration (D) $\frac{-\cos(\frac{x}{2})}{4}+\mathrm{c}$, where c is the constant of integration

144.

$$\int \frac{x^3}{(x+1)^2}dx=$$

(A) $\frac{x^2}{2}-2x+3\log(x+1)+\frac{1}{x+1}+c$ where c is the constant of integration

(B) $\frac{x^2}{2}+2x-3\log(x+1)+\frac{1}{x+1}+c$ where c is the constant of integration

(C) $\frac{x^2}{2}-2x+3\log(x+1)-\frac{1}{x+1}+\mathrm{c}$, where c is the constant of integratio

(D) $\frac{x^2}{2}-2x-3\log(x+1)-\frac{1}{x+1}+\mathrm{c}$, where c is the constant of integration

145. A wire of length 8 units is cut into two parts which are bent respectively in the form of a square and a circle. The least value of the sum of the areas so formed is

(A) $\frac{8}{\pi+4}$ (B) $\frac{64}{\pi+4}$

(C) $\frac{2}{\pi+4}$ (D) $\frac{16}{\pi+4}$

146. If $\mathrm{A}, \mathrm{B}, \mathrm{C}$ are mutually exclusive and exhaustive events of a sample space S such that $P(B)=\frac{3}{2}P(A)$ and $P(C)=\frac{1}{2}P(B)$, then $P(A)=$

(A) $\frac{4}{13}$ (B) $\frac{6}{13}$

(C) $\frac{8}{13}$ (D) $\frac{3}{13}$

147. Angle between the parabola $y^2=4(x-1)$ and $x^2+4(y-3)=0$ at the common end of their latus rectum is

(A) $\frac{\pi}{2}$ (B) $\frac{\pi}{4}$

(C) $\frac{\pi}{6}$ (D) $\frac{\pi}{3}$

148. The points $(1,3)$ and $(5,1)$ are two opposite vertices of a rectangle. The other two vertices are lie on the line $y=2x+\mathrm{c}$ where c is the constant, then co-ordinates of other two vertices are

(A) $(4,4),(2,0)$ (B) $(4,4),(1,0)$

(C) $(2,0),(4,1)$ (D) $(2,0),(1,-1)$

149. If $y=\mathrm{a}^x\cdot\mathrm{b}^{2x-1}$, then $\frac{\mathrm{d}^2y}{\mathrm{d}x^2}$ is equal to

(A) $y(\log(ab^2))$ (B) $y^2(\log(a\,\mathrm{b}^2))$

(C) $y(\log(ab^2))^2$ (D) $y^2(\log(ab))^2$

150. In a culture bacteria count is $1,00,000$ initially. The number increases by 10% in first 2 hours. In how many hours will the count reach $2,00,000$, if the rate of growth of bacteria is proportional to the number present?

(A) $\frac{2\log(\frac{11}{10})}{\log 2}$ (B) $\frac{\log(\frac{11}{10})}{\log 2}$

(C) $\frac{2\log 2}{\log(\frac{11}{10})}$ (D) $\frac{\log(2)}{\log(\frac{11}{10})}$

- End of Question Paper -