MHT CET 2020 PCM Oct 19 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 2020**, 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. A tuning fork A produces 5 beats per second with a tuning fork of frequency 480 Hz . When a little wax is stuck to a prong of fork A, the number of beats heard per second becomes 2 . What is the frequency of tuning fork A before the wax is stuck to it ?

(A) 475 Hz (B) 482 Hz

(C) 478 Hz (D) 485 Hz

2. Two spherical rain drops reach the surface of the earth with terminal velocities having ratio 16 : 9. The ratio of their surface area is

(A) 4 : 3 (B) 64 : 27

(C) 16 : 9 (D) 9 : 16

3. In system of two particles of masses m_1 and m_2, the first particle is moved by a distance d towards the centre of mass. To keep the centre of mass unchanged, the second particle will have to be moved by a distance

(A) $\frac{m_2}{m_1}d$, towards the centre of mass

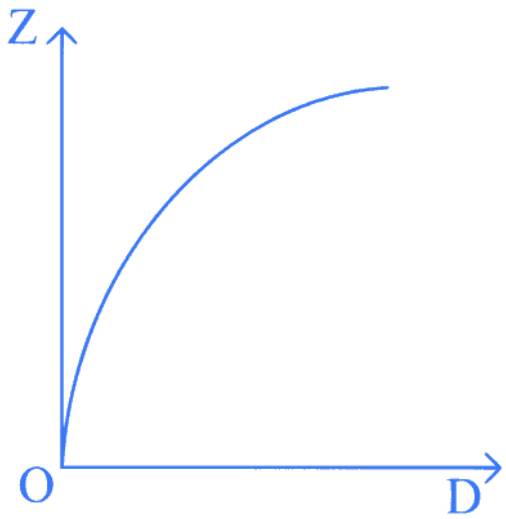
(B) $\frac{m_1}{m_2}d$, away from the centre of mass

(C) $\frac{m_1}{m_2}d$, towards the centre of mass

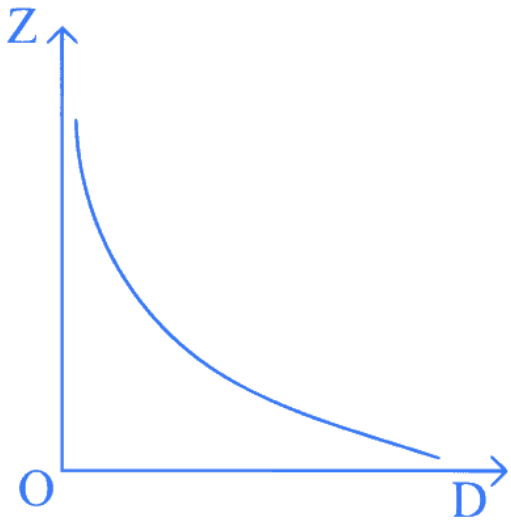
(D) $\frac{m_2}{m_1}d$, away from the centre of mass

4. A graph is plotted between the fringe-width Z and the distance D between the slit and eye-piece, keeping other adjustment same. The correct graph is

(A)

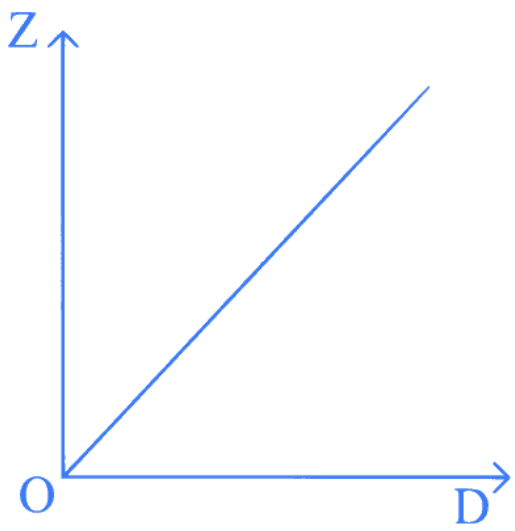


(B)

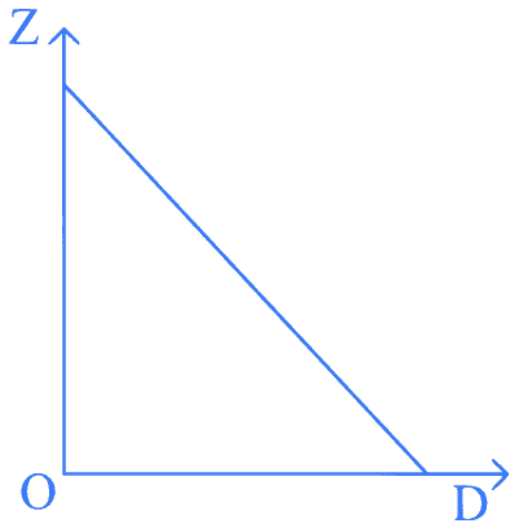


(C)

4. (continued)



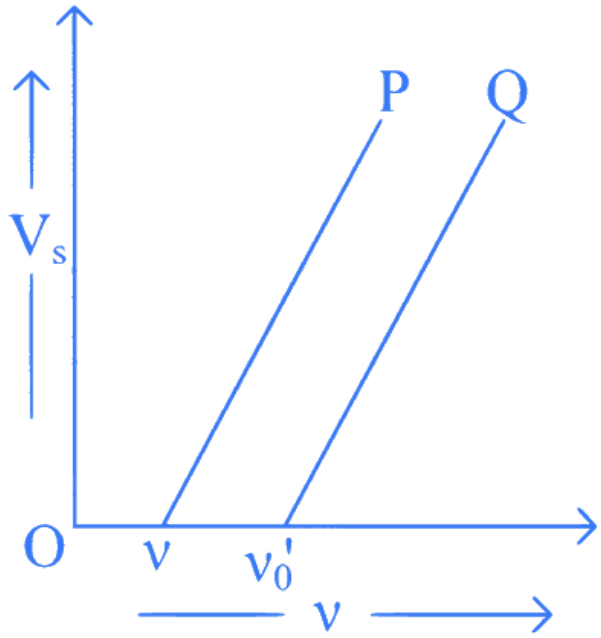
(D)



(A) A (B) B

(C) D (D) C

5. The graph of stopping potential V_s against frequency v of incident radiation is plotted for two different metals P and Q as shown in the graph. ϕ_p and ϕ_Q are work-functions of P and Q respectively, then



(A) $\varrho_P > \varrho_Q$ (B) $\varrho_P < \varrho_Q$

(C) $\varrho_P = \varrho_Q$ (D) $\nu_0^{'} < \nu_0$

6. An electron moves in a circular orbit with uniform speed v. It produces a magnetic field B at the centre of the circle. The radius of the circle is [μ_0 = permeability of free space, e = electronic charge]

(A) $(\frac{\mu_0 ev}{4\pi B})^{1/2}$ (B) $\frac{\mu_0 eB}{4\pi v}$

(C) $\frac{\mu_0 eV}{4\pi B}$ (D) $(\frac{\mu_0 ev}{B})^{1/2}$

7. If the maximum kinetic energy of emitted electrons in photoelectric effect is 3.2×10^{-19} J and the work-function for metal is 6.63×10^{-19} J, then stopping potential and threshold wavelength respectively are

[Planck's constant, $h = 6.63 \times 10^{34}$ J-s]

[Velocity of light, $c = 3 \times 10^8 \frac{\text{m}}{\text{s}}$]

[Charge on electron $= 1.6 \times 10^{-19}$C]

(A) 4V, 6000$\mathring{A}$ (B) 3V, 4000$\mathring{A}$

(C) 2V, 3000$\mathring{A}$ (D) 1V, 1000$\mathring{A}$

8. The root mean square velocity of molecules of a gas is 200 m/s. What will be the root mean square velocity of the molecules, if the molecular weight is doubled and the absolute temperature is halved?

(A) 50 m/s (B) 200 m/s

(C) 100 m/s (D) $\frac{100}{\sqrt{2}}$ m/s

9. Earth has mass M_1 and radius R_1. Moon has mass M_2 and radius R_2. Distance between their centre is r. A body of mass M is placed on the line joining them at a distance $\frac{r}{3}$ from centre of the earth. To project the mass M to escape to infinity, the minimum speed required is

(A) $[\frac{3G}{r}(M_1+\frac{M_2}{2})]^{\frac{1}{2}}$ (B) $[\frac{6G}{r}(M_1+\frac{M_2}{2})]^{\frac{1}{2}}$

(C) $[\frac{6G}{r}(M_1-\frac{M_2}{2})]^{\frac{1}{2}}$ (D) $[\frac{3G}{r}(M_1-\frac{M_2}{2})]^{\frac{1}{2}}$

10. Water rises upto a height h in a capillary tube on the surface of the earth. The value of h will increase, if the experimental setup is kept in [g = acceleration due to gravity]

(A) a lift going upward with a certain acceleration (B) accelerating train

(C) a satellite rotating close to earth (D) a lift going down with acceleration $a < g$

11. Van de Graaff generator produces

(A) high voltage and high current (B) high voltage and low current

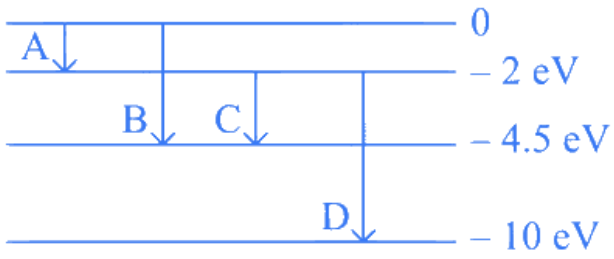
(C) low voltage and low current (D) low voltage and high current

12. A carrier wave of peak voltage 16 V is used to transmit a signal. If the modulation index is 75%, the peak voltage of the modulating signal is

(A) 18V (B) 12V

(C) 6V (D) 24V

13. The energy levels with transitions for the atom are shown. The transitions corresponding to emission of radiation of maximum and minimum wavelength are respectively



(A) B, C (B) A, C

(C) C, D (D) A, D

14. A milliammeter of resistance 40Ω has a range 0 – 30 mA. What will be the resistance used in series to convert it into voltmeter of range 0 – 15 V ?

(A) 460Ω (B) 920Ω

(C) 640Ω (D) 560Ω

15. A child starts running from rest along a circular track of radius r with constant tangential acceleration a. After time t he feels that slipping of shoes on the ground has started. The coefficient of friction between shoes and the ground is [g = acceleration due to gravity]

(A) $\frac{[a^4t^4+a^2r^2]^{\frac{1}{2}}}{gr}$ (B) $\frac{[a^4t^4+a^2r^2]}{rg}$

(C) $\frac{[a^2t^2+a^4r^4]}{rg}$ (D) $\frac{[a^4t^4-a^2r^2]^{\frac{1}{2}}}{rg}$

16. A metal rod has length, cross-sectional area and Young's modulus as L, A and Y, respectively. If the elongation in the rod produced is I, then work done is proportional to

(A) ℓ^4 (B) ℓ

(C) ℓ^3 (D) ℓ^2

17. Two cells having unknown emfs E_1 and E_2 $(E_1 > E_2)$ are connected in potentiometer circuit, so as to assist each other. The null point obtained is at 490 cm from the higher potential end. When cell E_2 is connected, so as to oppose cell E_1, the null point is obtained at 90 cm from the same end. The ratio of the emfs of two cells $\left(\frac{E_1}{E_2}\right)$ is

(A) 0.689 (B) 5.33

(C) 1.45 (D) 0.182

18. Three points masses, each of mass m are placed at the corners of an equilateral triangle of side ℓ. The moment of inertia of the system about an axis passing through one of the vertices and parallel to the side joining other two vertices, will be

(A) $\frac{3}{4}m\ell^2$ (B) $\frac{1}{4}m\ell^2$

(C) $\frac{3}{2}m\ell^2$ (D) $\frac{1}{2}m\ell^2$

19. Using Bohr's model, the orbital period of electron in hydrogen atom in nth orbit is ($\varepsilon_0 =$ permittivity of free space, $h =$ Planck's constant, $m =$ mass of electron and $\theta =$ electronic charge)

(A) $\frac{2\epsilon_0^2 n^3 h^3}{me^4}$ (B) $\frac{8\epsilon_0^2 n^3 h^3}{me^4}$

(C) $\frac{2\epsilon_0 n^2 h^2}{me^4}$ (D) $\frac{4\epsilon_0^2 n^3 h^3}{me^4}$

20. Let σ and b be Stefan's constant and Wien's constant respectively, then dimensions of σb are

(A) $[L^1M^{-1}T^{-3}K^{-3}]$ (B) $[L^1M^1T^3K^{-3}]$

(C) $[L^{-1}M^1\ \mathrm{T}^{-3}\ \mathrm{K}^{-3}]$ (D) $[L^1M^1T^{-3}K^{-3}]$

21. At the poles, a stretched wire of a given length vibrates in unison with a tuning fork. At the equator, for same setting to produce resonance with same fork, the vibrating length of wire

(A) should be same (B) should be increased

(C) should be decreased (D) should be 3 times the original length

22. A steel wire of length ℓ has a magnetic moment M. It is then bent into a semicircular arc. The new magnetic moment is

(A) $M \times \ell$ (B) $\frac{M}{\ell}$

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

23. The angle subtended by the vector $A = 4\hat{\mathbf{i}} + 3\hat{\mathbf{j}} + 12\hat{\mathbf{k}}$ with the X-axis is

(A) $\cos^{-1}(\frac{3}{13})$ (B) $\sin^{-1}(\frac{3}{13})$

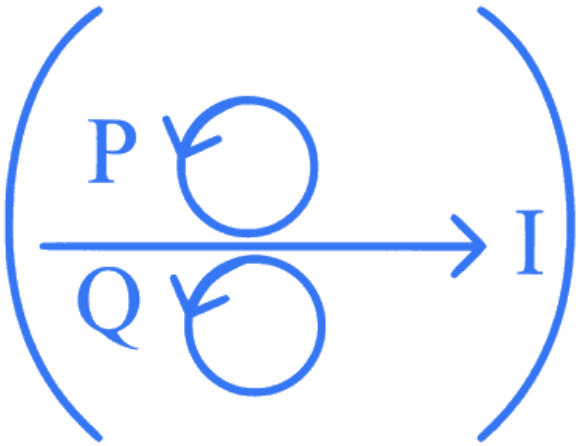
(C) $\sin^{-1}(\frac{4}{13})$ (D) $\cos^{-1}(\frac{4}{13})$

24. N number of balls of mass m kg moving along positive direction of X - axis, strike a wall per second and return elastically. The velocity of each ball is u m/s. The force exerted on the wall by the balls in newton, is

(A) 0 (B) $2mNu$

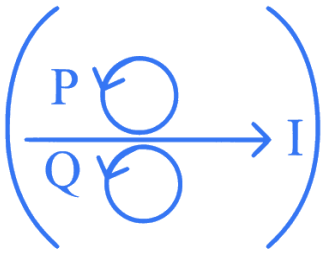
(C) $\frac{mNu}{2}$ (D) mNu

25. Metal rings P and Q are lying in the same plane, where current I is increasing steadily. The induced current in metal rings is shown correctly in figure

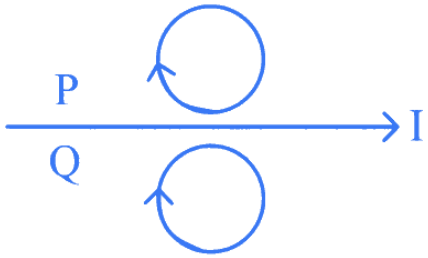


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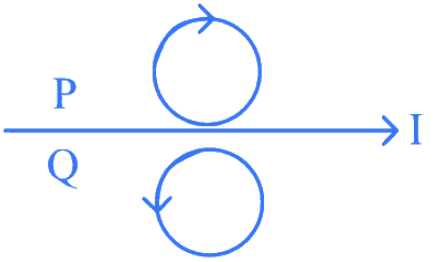
(A)



(B)



(C)



(D)

26. A 10 m long wire of resistance 20Ω is connected in series with a battery of emf 3 V and a resistance of 10Ω. The potential gradient along the wire in V/m is

(A) 1.2 (B) 0.10
(C) 0.02 (D) 0.20

27. A domain in a ferromagnetic substance is in the form of a cube of side 1μ m. If it contains 8×10^{10} atoms and each atomic dipole has a dipole moment of $9 \times 10^{-24}\text{Am}^2$, then the magnetisation of the domain is

(A) $7.2 \times 10^{5}\text{Am}^{-1}$ (B) $7.2 \times 10^{3}\text{Am}^{-1}$
(C) $7.2 \times 10^{9}\text{Am}^{-1}$ (D) $7.2 \times 10^{12}\text{Am}^{-1}$

28. If the surface tension of a soap solution is 3×10^{-2} N/m then the work done in forming a soap film of 20 cm × 5 cm will be

(A) 6×10^{-2} J (B) 6 J
(C) 6×10^{-4} J (D) 6×10^{-3} J

29. The compressibility of water is $5 \times 10^{-10}\ \text{m}^2/\text{N}$. Pressure of 15×10^{6} Pa is applied on 100 mL volume of water. The change in the volume of water is

(A) zero (B) 0.75 mL decrease
(C) 0.75 mL increase (D) 1.50 mL increase

30. Two bodies A and B of equal mass are suspended from two separate massles springs of force constant k_1 and k_2, respectively. The bodies oscillate vertically such that their maximum velocities are equal. The ratio of the amplitudes of body A to that of body B is

(A) $\sqrt{\frac{k_2}{k_1}}$ (B) $\frac{k_2}{k_1}$
(C) $\frac{k_1}{k_2}$ (D) $\sqrt{\frac{k_1}{k_2}}$

31. Two capacitors of capacities 2μ F and 4μ F are connected in parallel. A third capacitor of 6μ F capacity is connected in series with this combination. A battery of 12 V is connected across this combination. The charge on 2μ F capacitor is

(A) 12μC (B) 11μC
(C) 14μC (D) 16μC

32. The escape velocity of a body from any planet, whose mass is six times the mass of earth and radius is twice the radius of earth will (v_e = escape velocity of a body from the earth's surface)

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

33. A ray of light is incident at an angle i on one face of a thin angled prism. The ray emerges normally from the other face. Refractive inder of the glass prims is n and angle of prism is A. The value of i is

(A) An (B) A^2n
(C) An^2 (D) $\frac{1}{An}$

34. What is the angle between resultant of $A + B$ and $\mathbf{A} \times \mathbf{B}$.

(A) πrad (B) 0°
(C) $\frac{\pi}{4}$rad (D) $\frac{\pi}{2}$rad

35. A rope is wound around a solid cylinder of mass 1 kg and radius 0.4 m . What is the angular acceleration of cylinder, if the rope is pulled with a force of 25 N ? (Cylinder is rotating about its own axis.)

(A) 125 rad/s^2 (B) 10 rad/s^2
(C) 1 rad/s^2 (D) 50 rad/s^2

36. A transistor having $\alpha = 0.8$ is connected in common emitter configuration. When the base current changes by 6 mA , then the change in collector current is

(A) 12 mA (B) 24 mA
(C) 0.66 mA (D) 1.5 mA

37. A uniform metal wire has length L, mass M and density ρ. It is under tension T and v is the speed of transverse wave along the wire. The area of cross-section of the wire is

(A) $\frac{T}{v^2\rho}$ (B) $\frac{v^2\rho}{T}$
(C) $T^2\rho V$ (D) $Tv^2\rho$

38. An object is clearly seen through an astronomical telescope of length 50 cm . The focal lengths of its objective and eye-piece respectively, can be

(A) 5 cm and 45 cm (B) −45 cm and −5 cm
(C) 45 cm and −5 cm (D) 45 cm and 5 cm

39. A bob of a simple pendulum has mass m and is oscillating with an amplitude a. If the length of the pendulum is L, then the maximum tension in the string is $[\cos 0^\circ = 1,\ g =$ acceleration due to gravity]

(A) $mg[1 + (\frac{a}{L})^2]$ (B) $mg[1 - (\frac{L}{a})^2]$

(C) $mg[1 + (\frac{L}{a})^2]$ (D) $mg[1 - (\frac{a}{L})^2]$

40. The Brewster's angle for the glass-air interface is $(54.74)^\circ$. If a ray of light passing from air to glass strickes at an angle of incidence 45°, then the angle of refraction is

$$\left[\tan(54.74)^\circ = \sqrt{2}\ , \sin 45 = \frac{1}{\sqrt{2}}\right]$$

(A) $\sin^{-1}(\sqrt{2})$ (B) $\sin^{-1}(1)$

(C) $\sin^{-1}(0.5)$ (D) $\sin^{-1}(\frac{1}{\sqrt{2}})$

41. For a paramagnetic substance, the magnetic susceptibility is

(A) large and negative (B) small and positive

(C) large and positive (D) small and negative

42. Let $x = \pi R\left(\frac{P^2 - Q^2}{2}\right)$, where P, Q and R are lengths. The physical quantity x is

(A) area (B) length

(C) volume (D) velocity

43. The fundamental frequency of a closed pipe is 400 Hz . If $\frac{1}{3}$ rd pipe is filled with water, then the frequency of 2nd harmonic of the pipe will be (neglect and correction)

(A) 1200 Hz (B) 1800 Hz

(C) 600 Hz (D) 300 Hz

44. An AC circuit contains resistance of 12Ω and inductive reactance 5Ω. The phase angle between current and potential difference will be

(A) $\sin^{-1}(\frac{12}{13})$ (B) $\cos^{-1}(\frac{5}{12})$

(C) $\sin^{-1}(\frac{5}{12})$ (D) $\cos^{-1}(\frac{12}{13})$

45. In an intrinsic semiconductor, at an ordinary temperature, the correct relation between the number of electrons per unit volume n_e and number of holes per unit volume n_h.

(A) $n_e = n_h$ (B) $n_e > n_h$

(C) $n_e < n_h$ (D) $n_e = n_h = 0$

46. By increasing the aperture of the objective lens, wavelength of light, focal length of the objective lens and the resolving power of an astronomical telescope respectively

(A) is not affected, increases, increases (B) decreases, increases, is not affected

(C) increases, decreases, is not affected (D) is not affected, increases, decreases

47. Two galvanometers A and B require currents of 4 mA and 7 mA , respectively to produce the same deflection of 20 divisions. If S_A and S_B are their sensitivities respectively, then

(A) $S_A < S_B$ (B) $S_A > S_B$

(C) $S_B = \frac{7}{4} = S_A$ (D) $S_A = S_B = \frac{4}{7}$

48. Two circular loop A and B of radii R and NR respectively are made from a uniform wire. Moment of inertia of B about its axis is 3 times that of A about its axis. The value of N is

(A) $[2]^{\frac{1}{3}}$ (B) $[5]^{\frac{1}{3}}$

(C) $[3]^{\frac{1}{3}}$ (D) $[4]^{\frac{1}{3}}$

49. A body is moving along a circular track of radius 100 m with velocity 20 m/s. Its tangential acceleration is 3 $\mathrm{m/s^2}$, then its resultant acceleration will be

(A) 5 $\mathrm{m/s^2}$ (B) 4 $\mathrm{m/s^2}$

(C) 2 $\mathrm{m/s^2}$ (D) 3 $\mathrm{m/s^2}$

50. A body of mass 64 g is made to oscillate turn by turn on two different springs A and B. Spring A and B has force constant $4\frac{\mathrm{N}}{\mathrm{m}}$ and $16\frac{\mathrm{N}}{\mathrm{m}}$ respectively. If T_1 and T_2 are period of oscillations of springs A and B respectively, then $\frac{T_1+T_2}{T_1-T_2}$ will be

(A) 1 : 2 (B) 1 : 3

(C) 3 : 1 (D) 2 : 1

51. Which mineral among the following contains vanadium in it?

(A) Crocoisite (B) Azurite
(C) Carnotite (D) Malachite

52. Which of the following is least reactive towards S_N1 reactions?

(A) $CH_3 - CH_2 - Br$

(B) $CH_3 - CH(Br) - CH_3$

(C) $(CH_3)_3C - Br$

(D) $CH_3 - Br$

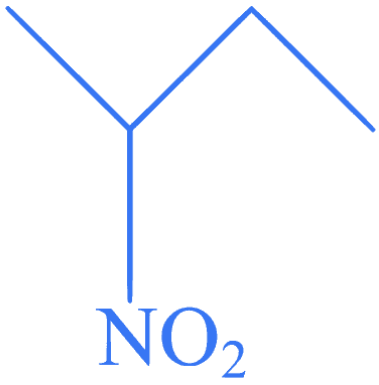
53. Which of the following oxyacids of sulphur contain four $S = O$ bonds?

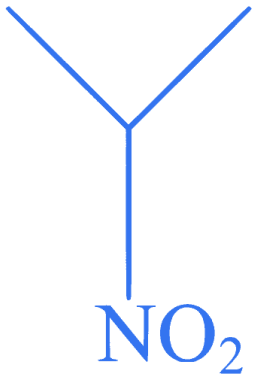
(A) H_2SO_5 (B) $H_2S_2O_4$
(C) H_2SO_4 (D) $H_2S_2O_6$

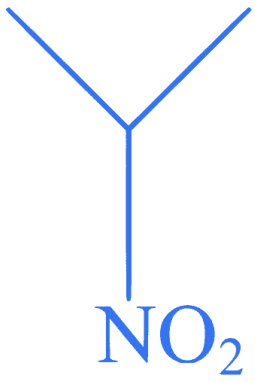
54. What is the unit of viscosity?

(A) Nm^{-1} (B) Nsm^{-2}
(C) kgs^{-1} (D) kgs^2

55. Which of the following compounds does not react with bromine in alkaline medium?

(A)


(B)


(C)


(D)


56. Which of the following molecules has a central atom with complete octet?

(A) Boron trifluoride (B) Methane

(C) Aluminium chloride (D) Sulphur hexafluoride

57. Which of the following molecular formula represents Marshall's acid?

(A) $H_2S_2O_7$ (B) $H_2S_2O_8$

(C) $H_2S_2O_6$ (D) H_2SO_5

58. An element crystallises in fcc type of unit cell. The volume of one unit cell is $24.99 \times 10^{-24}\ cm^3$ and density of the element $7.2\ g\ cm^{-3}$. Calculate the number of unit cells in 36 g of pure sample of element?

(A) 2.0×10^{23} (B) 1.25×10^{21}

(C) 2.0×10^{21} (D) 2.0×10^{24}

59. Which of the following reagents is used for the following conversion?

$CH_3 - CH = CH - CHO \longrightarrow CH_3 - CH = CH - CH_2OH$

(A) $LiAlH_4$ (B) $Zn - Hg/HCl$

(C) H_2/Ni (D) H_3O^+

60. Identify A in the following reaction.

$$A + CH_3MgBr \xrightarrow{\text{Ether}} \text{complex} \xrightarrow{H_3O^+} (CH_3)_3C - OH$$

(A) Acetone (B) Propionaldehyde

(C) Acetaldehyde (D) Acetyl chloride

61. Identify the number of donor groups present in EDTA.

(A) Six (B) Three

(C) Four (D) Two

62. Identify the enzyme X in the following reaction

$H_2O_2(aq) \xrightarrow{x} H_2O(l) + \frac{1}{2}O_2(g)$

(A) Catalase (B) Ferroxidase

(C) Amylase (D) Carbonic anhydrase

63. The Total number of electrons around the carbon atom of methyl free radical are

(A) nine (B) six

(C) seven (D) eight

64. Identify tranquiliser from the following?

(A) Prontosil (B) Aspirin

(C) Salvarsan (D) Meprobamate

65. Which reagent among the following is used to confirm presence of aldehydic carbonyl group in glucose?

(A) Dilute nitric acid (B) Bromine water

(C) Acetic anhydride (D) Hydroxylamine

66. What is the percentage of unoccupied space in fcc unit cell?

(A) 74% (B) 68%

(C) 32% (D) 26%

67. How many hydrogen atoms are surrounding each oxygen atom in structure of ice?

(A) 2 (B) 3

(C) 4 (D) 1

68. Which of the following is not an example of antiseptic drug?

(A) Sulphur dioxide (B) Cloroxylenol

(C) Hydrogen peroxide (D) Bithional

69. Which of the following compounds is obtained, when phenol react with bromine water?

(A) 4-bromophenol (B) 2, 4, 6 - tribromophenol

(C) 2-bromophenol (D) 3-bromophenol

70. What is standard $N \equiv N$ bond enthalpy from following reaction,

$N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g); \Delta H^\circ = -83\ kJ$

$(\Delta H^\circ(H - H) = 435\ kJ; \Delta H^\circ(N - H) = 389\ kJ)$

(A) 435 kJ (B) 1305 kJ

(C) 2334 kJ (D) 946 kJ

71. Which of the following is correct decreasing order of the repulsive interaction of electron pairs in a molecule?

(A) bond pair - bond pair > lone pair - bond pair > lone pair - long pair

(B) lone pair - bond pair > lone pair - lone pair > bond pair - bond pair

(C) bond pair - bond pair = bond pair - long pair > lone pair - lone pair

(D) lone pair - lone pair > lone pair - bond pair > bond pair - bond pair

72. For first order reaction the concentration of reactant decreases from 0.2 to 0.1 M in 100 minutes. What is the rate constant of the reaction?

(A) $144.3\ \text{min}^{-1}$ (B) $69.3\ \text{min}^{-1}$

(C) $6.93 \times 10^{-3}\ \text{min}^{-1}$ (D) $6.93\ \text{min}^{-1}$

73. The end product C of the following reaction is

$$C_2H_5NH_2 \xrightarrow{HNO_2} A \xrightarrow{PCl_5} B \xrightarrow[\text{Alcohol}]{NH_3} C$$

(A) Nitroethane (B) Ethanol

(C) Chloroethane (D) Ethanamine

74. Which among the following sets of elements is present in chalcopyrite?

(A) Al, O (B) Cu, Fe, S

(C) Al, Fe, O (D) Fe, S

75. Which of the following pairs of monomers is used for the preparation of dextron?

(A) 3-hydroxy butanoic acid and 3-hydroxy pentanoic acid (B) Glycine and ω-amino caproic acid

(C) Lactic acid and glycolic acid (D) Isobutylene and Isoprene

76. What is the oxidation number of Mn in MnO_4^{2-} ion?

(A) $+6$ (B) $+8$

(C) -8 (D) -6

77. The vapour pressure of solvent decreases by 10 mm Hg , if mole fraction of non-volatile solute is 0.2 . Calculate vapour pressure of solvent.

(A) 70 mm of Hg (B) 40 mm of Hg

(C) 50 mm of Hg (D) 60 mm of Hg

78. Identify ' B ' in the following reaction.

$$C_2H_6 \xrightarrow[AlBr_3]{Br_2} A \xrightarrow[\Delta]{CH_3COOAg} B$$

(A) $C_2H_5COOCH_3$ (B) $CH_3COOC_2H_5$

(C) $C_2H_5COOC_2H_5$ (D) CH_3COOCH_3

79. Which of the following is a Stephen reaction?

(A) $RC \equiv N + 2[H] \xrightarrow[\text{dil. HCl}]{SnCl_2} R{-}CH{=}NH.$

$$HCl \xrightarrow{H_3O^+} R{-}\overset{\overset{H}{|}}{C}{=}O + NH_4Cl$$

(B) $R{-}\overset{\overset{O}{\|}}{C}{-}R + 4[H] \xrightarrow[\Delta]{\text{Zn-Hg/conc.HCl}} R{-}CH_2{-}R + H_2O$

(C) $R{-}COCl \xrightarrow[Pd\text{-}BaSO_4]{H_2} R{-}CHO + HCl$

(D) $R{-}CH{=}O \xrightarrow[-H_2O]{H_2N{-}NH_2} R{-}CH{=}N{-}NH_2 \xrightarrow[\Delta]{\text{KOH/ethylene glycol}} R{-}CH_3 + N_2$

80. Which among the following crystal lattices occupies all of the cubic holes by cations?

(A) UO_2 (B) CsCl

(C) CaF_2 (D) $SrCl_2$

81. What is the name of reaction involving replacement of diazonium group by chloride using cuprous (I) salt ?

(A) Wolff -Kishner reduction (B) Sandmeyer's reaction

(C) Balz Schiemann reaction (D) Friedel Craft's reaction

82. How many moles of gaseous oxygen at one atmosphere is considered for the reaction with element for plotting a graph in Ellingham diagram?

(A) 0.5 (B) 2

(C) 1 (D) 0.25

83. How many Faradays of electricity is required to produce 4.8 g of Mg at cathode in the electrolysis of molten $MgCl_2$? (Molar mass of Mg $= 24$ g/mol)

(A) 4 F (B) 0.4 F

(C) 1 F (D) 10 F

84. Which of the following compound is highly reactive towards HCN?

(A) $C_6H_5 - CHO$ (B) $H - CHO$

(C) $CH_3 - CHO$ (D) $CH_3 - CO - CH_3$

85. What is the range of number of carbon atoms in alkanes found in paraffin wax?

(A) C_{21} to C_{30} (B) C_{19} to C_{20}

(C) C_6 to C_8 (D) C_{17} to C_{18}

86. Which of the following amines is most basic in nature in aqueous phase?

(A) Methylamine (B) Trimethylamine

(C) Dimethylamine (D) Ammonia

87. Which of the following $0 - 10$ m aqueous solutions will have maximum ΔT_f value?

(A) $C_{12}H_{22}O_{11}$ (B) KI

(C) $Al_2(SO_4)_3$ (D) $NH_2 - CO - NH_2$

88. If boiling point of urea solution is 100.18°C and K_b for water is 0.512 K kg mol^{-1}, molality of solution is (Boiling point of water = 100°C)

(A) 0.6 mol kg^{-1} (B) 0.25 mol kg^{-1}

(C) 0.35 mol kg^{-1} (D) 0.45 mol kg^{-1}

89. What is the SI unit for electrochemical equivalent?

(A) Js^{-1} (B) JC^{-1}

(C) kgC (D) kgC^{-1}

90. Number of electrons involved in the reaction, when 1 Faraday of electricity is passed through an electrolytic solution is

(A) 12×10^{46} (B) 96500

(C) 6.022×10^{23} (D) 8×10^{16}

91. Which carbon atoms of $\alpha - D$ glucopyranose and β-D-fructofuranose respectively are linked together to form glycosidic linkage in sucrose?

(A) C-2 of α-D-glucopyranose and C - 2 of β - D fructofuranose

(B) C-1 of α-D-glucopyranose and C - 2 of β-D fructofuranose

(C) C-1 of α-D-glucopyranose and $C - 6$ of β-D fructofuranose

(D) C-2 of α-D-glucopyranose and $C - 3$ of β-D fructofuranose?

92. Which of the following compounds reacts with ammonia to form urotropine?

(A) Ethanal (B) Propanone

(C) Propanal (D) Methanal

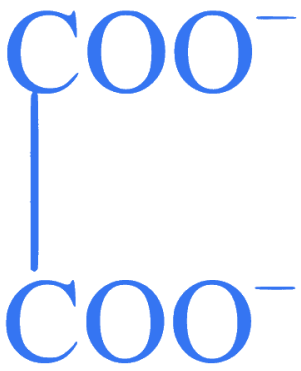
93. A first order reaction is 25% completed in 40 minutes. What is the rate constant k for the reaction?

(A) $\frac{2.303 \times \log 1.33}{40}$ (B) $2.303 \times \log \frac{4}{3}$

(C) $\frac{2.303 \times \log 4}{40 \times 3}$ (D) $\frac{2.303}{40} \times \log \frac{1}{4}$

94. Which among the following is an ambidentate ligand?

(A)



(B) NO_2^-

(C)



(D) H_2O

95. What is the formula of hydrolith?

(A) MgH_2 (B) BaH_2

(C) BeH_2 (D) CaH_2

96. For the reaction,

$$N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g); \Delta H$$

is equal to

(A) $\Delta U + 2RT$ (B) $\Delta U - RT$

(C) $\Delta U - 2RT$ (D) $\Delta U + RT$

97. What is the highest oxidation state possessed by phosphorus in it's oxyacids?

(A) +5 (B) +3

(C) +6 (D) +4

98. When 6.0 g of graphite reacts with dihydrogen to give methane gas, 37.4 kJ of heat is liberated. What is standard enthalpy of formation of $CH_4(g)$?

(A) $-74.8\ kJ\ mol^{-1}$ (B) $-37.4\ kJ\ mol^{-1}$

(C) $-112.2\ kJ\ mol^{-1}$ (D) $112.2\ kJ\ mol^{-1}$

99. Which among the following polymers is used for making handles of cooker?

(A) Bakelite (B) Novolac

(C) Melamine (D) Acrilan

100. Identify the correct decreasing order of densities of *d*-block elements.

(A) $V > Cr > Fe > Ni$ (B) $Ni > Fe > Cr > V$

(C) $Fe > Ni > V > Cr$ (D) $Cr > Fe > V > Ni$

101. With usual notations, if the angles A, B, C of a $\triangle ABC$ are in AP and $b : c = \sqrt{3} : \sqrt{2}$

(A) 75° (B) 55°

(C) 35° (D) 45°

102.

$$\int \sin^{-1} x dx =$$

(A) $x\sin^{-1}x - \sqrt{1+x^2} + C$

(B) $x\sin^{-1}x - \sqrt{1-x^2} + C$

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

(D) $x\sin^{-1}x + \sqrt{1+x^2} + C$

103. The integrating factor of the differential equation $x\frac{dy}{dx} + y\log x = x^2$ is

(A) $x^{\log(\sqrt{x})}$ (B) $(\log x)^2$

(C) $x^{\log x}$ (D) $(\log x)^x$

104. If $\mathbf{a} = 3\hat{\mathbf{i}} + \hat{\mathbf{j}} - \hat{\mathbf{k}}, \mathbf{b} = 2\hat{\mathbf{i}} - \hat{\mathbf{j}} + 7\hat{\mathbf{k}}$ and $\mathbf{c} = 7\hat{\mathbf{i}} - \hat{\mathbf{j}} + 23\hat{\mathbf{k}}$ are three vectors, then which of the following statement is true.

(A) $\mathbf{a}$ and b are collinear

(B) a, b, c are mutually perpendicular

(C) a, b and c are coplanar

(D) a, b and c are non-coplanar

105. The maximum volume of a right circular cylinder if the sum of its radius and height is 6 m is

(A) 64π m^3 (B) $16\pi m^3$

(C) 32π m^3 (D) $4\pi m^3$

106. If the slopes of the lines given by the equation $ax^2 + 2hxy + by^2 = 0$ are in the ratio $5 : 3$, then the ratio $h^2 : ab =$

(A) $3 : 5$ (B) $16 : 15$

(C) $5 : 3$ (D) $15 : 16$

107. The equation of a line passing through the point $(7, -4)$ and perpendicular to the line passing through the points $(2, 3)$ and $(1, -2)$ is

(A) $x + 5y + 13 = 0$ (B) $x - 2y - 15 = 0$

(C) $x - 5y - 13 = 0$ (D) $x + 2y + 1 = 0$

108. $\int_0^1 \tan^{-1}\left(\frac{2x-1}{1+x-x^2}\right) dx =$

(A) 2 (B) 1

(C) 0 (D) 4

109. If $f(x) = \frac{1-\sin x+\cos x}{1+\sin x+\cos x}$, for $x \neq \pi$ is continuous at $x = \pi$, then $f(\pi) =$

(A) 1 (B) -1

(C) 0 (D) 2

110. $\mathbf{a}$ and $\mathbf{b}$ are non-collinear vectors. If $p = (2x+1)a - b$ and $q = (x-2)a + b$ are collinear vectors, then $x =$

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

(C) -3 (D) 3

111. If $A = \begin{bmatrix} 4 & 5 \\ 2 & 1 \end{bmatrix}$ and $A^2 - 5A - 6I = 0$, then $A^{-1} =$

(A) $\frac{1}{6}\begin{bmatrix} -1 & 5 \\ -2 & -4 \end{bmatrix}$. (B) $\frac{1}{6}\begin{bmatrix} -1 & 5 \\ 2 & 4 \end{bmatrix}$

(C) $\frac{1}{6}\begin{bmatrix} -1 & 5 \\ 2 & -4 \end{bmatrix}$ (D) $\frac{1}{6}\begin{bmatrix} 1 & 5 \\ 2 & -4 \end{bmatrix}$

112. The quadratic equation whose roots are the numbers having arithmetic mean 34 and geometric mean 16 is

(A) $x^2 + 68x + 256 = 0$ (B) $x^2 + 68x - 256 = 0$

(C) $x^2 - 68x + 256 = 0$ (D) $x^2 - 68x - 256 = 0$

113. If $x = a\sin t - b\cos t, y = a\cos t + b\sin t$, then $y^3\frac{d^2y}{dx^2} + x^2 + y^2 =$

(A) 2 (B) 1

(C) 0 (D) -1

114. The area of the triangle formed by the lines joining vertex of the parabola $x^2 = 12y$ to the extremities of its latus rectum is

(A) 18 sq units (B) 38 sq units

(C) 12 sq units (D) 28 sq units

115. If the sum of the mean and the variance of a binomial distribution for 5 trials is 1.8 , then $p =$

(A) 0.4 (B) 0.8

(C) 0.18 (D) 0.2

116. The odds in favour of getting sum multiple of 3 , when pair of dice are thrown is

(A) $4:5$ (B) $3:4$

(C) $2:3$ (D) $1:2$

117. The rate of disintegration of a radio active element at time t is proportional to its mass, at the time. Then the time during which the original mass of 1.5 gm . Will disintegrate into its mass of 0.5 gm . is proportional to

(A) log5 (B) log3

(C) log2 (D) log4

118. If $\mathbf{a},\mathbf{b},\mathbf{c}$ are non-coplanar vectors and $p=\frac{\mathbf{b}\times\mathbf{c}}{[abc]}, q=\frac{\mathbf{c}\times\mathbf{a}}{[abc]}, r=\frac{\mathbf{a}\times\mathbf{b}}{[abc]}$, then $\mathbf{a}\cdot\mathbf{p}+\mathbf{b}\cdot\mathbf{q}+\mathbf{c}\cdot\mathbf{r}=$

(A) 0 (B) 2

(C) 3 (D) 1

119. The negation of the statement pattern $\sim p\vee(q\rightarrow\sim r)$ is

(A) $p\wedge(q\wedge r)$ (B) $\sim p\wedge(q\wedge r)$

(C) $p\vee(q\wedge r)$ (D) $p\rightarrow(q\wedge\sim r)$

120. The point P lies on the line A,B where $A=(2,4,5)$ and $B\equiv(1,2,3)$. If z co-ordinate of point P is 3 , the its y co-ordinate is

(A) 3 (B) -3

(C) 2 (D) -2

121. If $R=\{(a,b)/b=a-1, a\in Z, 5<a<9$, then the range of R is

(A) $\{7,8,9\}$ (B) $\{5,6,7\}$

(C) $\{5,6,7,8,9\}$ (D) $\{6,7,8\}$

122.

$$\int \log x\cdot(\log x+2)dx=$$

(A) $x(\log x)^2+c$ (B) $x\log x+c$

(C) $e^x(\log x)^2+c$ (D) $(\log x)^2+c$

123. The c.d.f, $F(x)$ associated with p.d.f. $f(x)=3\left(1-2x^2\right)$. If $0<x<1$ is $k\left(x-\frac{2x^3}{k}\right)$, then value of k is

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

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

124. The range of the function $f(x)=\frac{x-3}{5-x}, x\neq 5$ is

(A) $R-\{-5\}$ (B) $R-\{-1\}$

(C) $R-\{1\}$ (D) $R-\{5\}$

125. If $y=\sin^{-1}\left[\frac{\sqrt{1+x}+\sqrt{1-x}}{2}\right]$, then $\frac{dy}{dx}=$

(A) $\left(\frac{1}{4}\right)\frac{1}{\sqrt{x^2-1}}$ (B) $\left(-\frac{1}{2}\right)\frac{1}{\sqrt{x^2-1}}$

(C) $\left(-\frac{1}{2}\right)\frac{1}{\sqrt{1-x^2}}$ (D) $\left(\frac{1}{4}\right)\frac{1}{\sqrt{1-x^2}}$

126. The area of the $\triangle ABC$ is $10\sqrt{3}$ cm^2, angle B is 60° and its perimeter is 20 cm , then $\ell(AC)=$

(A) 5 cm (B) 10 cm

(C) 7 cm (D) 8 cm

127. The equation of the normal to the curve $2x^2+y^2=12$ at the point $(2,2)$ is

(A) $2x+y-6=0$ (B) $x-2y+2=0$

(C) $2x-y+6=0$ (D) $x+2y+2=0$

128.

$$\frac{1-\sin\theta+\cos\theta}{1-\sin\theta-\cos\theta}=$$

(A) $-\cot\frac{\theta}{2}$ (B) $\cot\frac{\theta}{2}$

(C) $\tan\frac{\theta}{2}$ (D) $-\tan\frac{\theta}{2}$

129. If A and B are supplementary angles, then $\sin^2\frac{A}{2}+\sin^2\frac{B}{2}=$

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

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

130. If the equation $3x^2+10xy+3y^2+16y+k=0$ represents a pair of lines, then the value of kis

(A) -21 (B) 12

(C) -12 (D) 21

131. If $2\cos^2\theta+3\cos\theta=2$, then permissible value of $\cos\theta$ is

(A) 0 (B) $\frac{1}{2}$

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

132. A line makes angles α,β,γ with the co-ordinate axes and $\alpha+\beta=90^\circ$, then $\gamma=$

(A) 30° (B) 90°

(C) 60° (D) 45°

133. The equations of planes parallel to the plane $x + 2y + 2z + 8 = 0$, which are at a distance of 2 units from the point $(1, 1, 2)$ are

(A) $x + 2y + 2z - 5 = 0$ or $x + 2y + 2z - 3 = 0$

(B) $x + 2y + 2z - 6 = 0$ or $x + 2y + 2z - 7 = 0$

(C) $x + 2y + 2z - 13 = 0$ or $x + 2y + 2z - 1 = 0$

(D) $x + 2y + 2z + 3 = 0$ or $x + 2y + 2z - 5 = 0$

134. If X is a.r.v. with c.d.f $F(x)$ and its probability distribution is given by

$X = x$	-1.5	-0.5	**0.5**	**1.5**	**2.5**
$P(X = x)$	0.05	0.2	0.15	0.25	0.35

then, $F(1.5) - F(-0.5) =$

(A) 0.2 (B) 0.4

(C) 0.1 (D) 0.3

135.

$$\int \frac{dx}{x^2 + 4x + 13} =$$

(A) $\frac{1}{3}\tan^{-1}(\frac{x+2}{3}) + C$ (B) $\frac{1}{6}\log(\frac{x-1}{x+5}) + C$

(C) $3\tan^{-1}(\frac{x+2}{3}) + C$ (D) $\frac{1}{6}\tan^{-1}(\frac{x+2}{3}) + C$

136. If $x^2y^2 = \sin^{-1}\sqrt{x^2 + y^2} + \cos^{-1}\sqrt{x^2 + y^2}$ then $\frac{dy}{dx} =$

(A) $\frac{-x}{y}$ (B) $\frac{x}{y}$

(C) $\frac{-y}{x}$ (D) $\frac{y}{x}$

137.

$$\int_0^{\frac{\pi}{2}} \frac{\sqrt[7]{\sin x}}{\sqrt[7]{\sin x} + \sqrt[7]{\cos x}} dx =$$

(A) $\frac{\pi}{8}$ (B) $\frac{\pi}{3}$

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

138. $\int_0^1 \left(1 - \frac{x}{1!} + \frac{x^2}{2!} - \frac{x^3}{3!} + \ldots \text{ upto } \infty\right) e^{2x} dx =$

(A) e^2 (B) $e + 1$

(C) e (D) $e - 1$

139. The principal solutions of $\cot x = \sqrt{3}$ are

(A) $\frac{\pi}{6}, \frac{7\pi}{6}$ (B) $\frac{\pi}{3}, \frac{7\pi}{3}$

(C) $\frac{\pi}{4}, \frac{5\pi}{4}$ (D) $\frac{\pi}{6}, \frac{5\pi}{6}$

140. The statement pattern $p \wedge (q \vee \sim p)$ is equivalent to

(A) $p \wedge q$ (B) $q \wedge \sim p$

(C) $p \vee q$ (D) $p \to q$

141. The LPP to maximize $Z = x + y$, subject to $x + y \leq 1, 2x + 2y \geq 6, x \geq 0, y \geq 0$ has

(A) infinite solutions (B) one solution

(C) no solution (D) two solutions

142. The area of the region bounded by the curve $y = \sin x$ between $x = -\pi$ and $x = \frac{3\pi}{2}$ is

(A) 1 (unit) ^{2} (B) 3 (unit) ^{2}

(C) 5 (unit) ^{2} (D) 2(unit)^2

143. The equation of a plane containing the point $(1, -1, 2)$ and perpendicular to the planes $2x + 3y - 2z = 5$ and $x + 2y - 3z = 8$ is

(A) $r(4\hat{i} - 5\hat{j} + 3\hat{k}) = 15$

(B) $\mathbf{r}(5\hat{i} + 4\hat{j} + 2\hat{k}) = 5$

(C) $\mathbf{r}(5\hat{i} + 4\hat{j} - \hat{k}) = 5$

(D) $\mathbf{r}(5\hat{i} - 4\hat{j} - \hat{k}) = 7$

144. The general solution of the differential equation $(1 + y^2) + \left(x - e^{\tan^{-1}y}\right)\frac{dy}{dx} = 0$ is

(A) $x \cdot e^{\tan^{-1}y} = \frac{(e^{\tan^{-1}y})^2}{2} + C$

(B) $e^{\tan^{-1}y} = (e^{\tan^{-1}x})^2 + C$

(C) $x \cdot e^{\tan^{-1}y} = \frac{(e^{\tan^{-1}x}x)^2}{2} + C$

(D) $e^{\tan^{-1}y} = (e^{\tan^{-1}y})^2 + C$

145. The equation of the line passing through $(1, 2, 3)$ and perpendicular to the lines $x - 1 = \frac{y+2}{2} = \frac{z+4}{4}$ and $\frac{x-1}{2} = \frac{y-2}{2} = z + 3$ is

(A) $x - 1 = \frac{y-2}{2} = \frac{z-3}{4}$ (B) $\frac{x-1}{4} = \frac{2-y}{5} = \frac{z-3}{2}$

(C) $\frac{x-1}{6} = \frac{y-2}{7} = \frac{z-3}{2}$ (D) $\frac{x-1}{6} = \frac{2-y}{7} = \frac{z-3}{2}$

146. The cofactors of the elements of the first column of the matrix $A = \begin{bmatrix} 2 & 0 & -1 \\ 3 & 1 & 2 \\ -1 & 1 & 2 \end{bmatrix}$ are

(A) $0, -7, 2$ (B) $-1, 3, -2$

(C) $0, -8, 4$ (D) $0, -1, 1$

147. The equation of the directrix of the parabola $3x^2 = 16y$ is

(A) $3y - 4 = 0$ (B) $3y + 4 = 0$

(C) $3x + 4 = 0$ (D) $3x - 4 = 0$

148. The order and degree of the differential equation $\left[1+\frac{1}{\left(\frac{dy}{dx}\right)^2}\right]^{\frac{5}{3}}=5\frac{d^2y}{dx^2}$ are respectively

(A) 3, 2 (B) 5, 2

(C) 2, 5 (D) 2, 3

149. If the population grows at the rate of 8% per year, then the time taken for the population to be doubled, is (Given $\log 2 = 0.6912$)

(A) 10.27 yr (B) 4.3 yr

(C) 6.8 yr (D) 8.64 yr

150. The area of the square increases at the rate of 0.5 cm^2/sec. The rate at which its perimeter is increasing when the side of the square is 10 cm long, is

(A) 0.2 cm/sec (B) 0.3 cm/sec

(C) 0.4 cm/sec (D) 0.1 cm/sec

- End of Question Paper -