MHT CET 2022 PCM Aug 7 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 2022**, 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 particle of mass ' m ' performs uniform circular motion of radius ' r ' with linear speed ' v ' under the application of force ' F '. If m, v and r are all increased by 50%, the necessary change in force required to maintain the particle in uniform circular motion is

(A) 125%
(B) 150%
(C) 100%
(D) 225%

2. A road is 10 metre wide. Its radius of curvature is 50 metre. The outer edge is above the inner edge by a distance of 1.5 metre. This road is most suited for the velocity [g = 9.8 m/s^2]

(A) 2.5 m/s
(B) 6.5 m/s
(C) 4.5 m/s
(D) 8.5 m/s

3. A bullet is fired from the gun. It hits the solid block resting on a frictionless surface, gets embedded into it and both move jointly. In this process,

(A) Both momentum and kinetic energy are not conserved.
(B) Only kinetic energy is conserved.
(C) Bot the momentum and kinetic energy are conserved.
(D) Only momentum is conserved.

4. A disc of mass 25 kg and radius 0.2 m is rotating at 240 r.p.m. A retarding torque brings it to rest in 20 s. If the torque is due to a force applied tangentially on the rim of the disc, then the magnitude of the force in newton is

(A) 2π
(B) 3π
(C) 4π
(D) π

5. Match the following columns (R = radius, k = Radius of gyration)

	Column I		Column II
(A)	'k' for a solid sphere rotating about its tangent	(P)	$\sqrt{2}$R
(B)	'k' for a ring rotating about its tangent perpendicular to its plane	(Q)	$\frac{R}{2}$
(C)	'k' for a uniform solid right circular cone rotating about its central axis	(R)	$\frac{\sqrt{7}}{\sqrt{5}}$R
(D)	'k' for a uniform disc rotation about its diameter	(S)	$\frac{\sqrt{3}}{\sqrt{10}}$R

(A) (A) − (p); (B) − (R); (C) − (Q); (D) − (s)
(B) (A) − (p); (B) − (Q); (C) − (s); (D) − (P)
(C) (A) − (Q); (B) − (R); (C) − (p); (D) − (S)
(D) (A) − (R); (B) − (P); (C) − (S); (D) − (Q)

6. A body weighs ' W ' newton on the surface of the earth its weight at a height equal to half the radius of the earth, will be

(A) $\frac{W}{2}$
(B) $\frac{2W}{3}$
(C) $\frac{4W}{9}$
(D) $\frac{8W}{27}$

7. A geostationary satellite is revolving around the earth. If radius of the earth is ' R ' and the angular speed about its own axis is ' ω ' then the radius of the orbit of the geostationary satellite is (g = acceleration due to gravity)

(A) $\left[\frac{R^2\omega^2}{g}\right]^{1/3}$
(B) $\left[\frac{Rg}{\omega^2}\right]^{1/3}$
(C) $\left[\frac{R^2g}{\omega}\right]^{1/3}$
(D) $\left[\frac{R^2g}{\omega^2}\right]^{1/3}$

8. The amount of work done in blowing a sops bubble such that its diameter increases from ' d ' to D ' is (T = surface tension of solution)

(A) $4\pi\left(D^2-d^2\right)T$ (B) $8\pi\left(D^2-d^2\right)T$

(C) $\pi\left(D^2-d^2\right)T$ (D) $2\pi\left(D^2-d^2\right)T$

9. A lead sphere of mass' m ' falls in a viscous liquid with terminal velocity ' V ' Another lead sphere of mass ' 8 m ' will fall through the same liquid with terminal velocity

(A) V (B) 64 V

(C) 8 V (D) 4 V

10. Water rises in a capillary tube of radius ' r ' upto height ' h ' The mass of water in the capillary is ' m ' The mass of water will rise in a capillary of radius will $\frac{r}{4}$ be

(A) 4 m (B) $\frac{\mathrm{m}}{4}$

(C) m (D) $\frac{4}{\mathrm{m}}$

11. A cylindrical metallic rod in thermal contact with two reservoirs of heat at its two end conduct an amount of heat ' Q_1 ' in time ' t ' the metallic rod is melted and the material is formed into a rod of length four times the length of original rod. The amount of heat conducted by the new rod when placed in thermal contact with the same two reservoirs in time t is ' Q_2 '. Then $\frac{Q_1}{Q_2}$ is

(A) 16 (B) $\frac{1}{16}$

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

12. Two solid spheres of radii R_1 and R_2 made of same material and have similar surfaces. The spheres are raised to the same temperature and then allowed to cool under identical conditions. Assuming spheres to be perfect conductors of heat, then the ratio of initial rates of cooling are

(A) $\frac{R_1^2}{R_2^2}$ (B) $\frac{R_1^4}{R_2^4}$

(C) $\frac{R_2^3}{R_1^3}$ (D) $\frac{R_2}{R_1}$

13. A container A contains an ideal gas at pressure P' volume ' V ' and temperature ' T '. A second container B contains the same gas at pressure ' 2P ', volume ' 2 V ' and temperature $\frac{\mathrm{T}}{2}$. The ratio of mass of gas in A to that in B is

(A) 1 : 4 (B) 1 : 8

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

14. A sample of a gas expends from volume V_1' to V_2 The amount of work done by the gas is maximum when the expansion is

(A) Adiabatic (B) Equal in isothermal and isobaric

(C) Isothermal (D) Isobaric

15. If one mole of an ideal gas $\left(\gamma=\frac{5}{3}\right)$ is mixed with one mole of a diatomic gas $\left(\gamma=\frac{7}{5}\right)$. The value of γ for the mixture is

(A) 1.50 (B) 1.53

(C) 3.07 (D) 1.40

16. According to the kinetic theory of gases, which of the following statements is WRONG?

(A) The pressure exerted by a gas is due to the collisions between the molecules of the gas

(B) Collisions between the molecules of a gas and that of the molecules with the walls of the containers are perfectly elastic

(C) All molecules of a gas are identical

(D) The molecules do not exert appreciable force on one another except during collision

17. A U-tube of a uniform bore is with its arm vertical. The length of the liquid in the two arms or the U-tube is L; the time period T of the oscillation of the liquid column when it is displaced by ' Y ' is (g = acceleration due to gravity)

(A) $2\pi\sqrt{\frac{Y}{g}}$ (B) $2\pi\sqrt{\frac{2L}{g}}$

(C) $2\pi\sqrt{\frac{L}{g}}$ (D) $2\pi\sqrt{\frac{L}{2g}}$

18. A sphere of radius ' r ' is Kept on a concave minor of radius of curvature ' R ' The arrangement is kept on a horizontal table If the sphere is displaced from its equilibrium position and left then it executes S.H.M. The period of oscillation will be (g = acceleration due to gravity.)

(A) $2\pi[(\mathrm{R}/\mathrm{gr})]^{\frac{1}{2}}$ (B) $2\pi[(\mathrm{R}-\mathrm{r})/\mathrm{g}]^{\frac{1}{2}}$

(C) $2\pi[(\mathrm{R}-\mathrm{r})1.4/\mathrm{g}]^{\frac{1}{2}}$ (D) $2\pi[(\mathrm{Rr})/\mathrm{g}]^{\frac{1}{2}}$

19. For a particle performing S.H.M., which of the following statement is INCORRECT?

(A) Acceleration of the particle is minimum at the mean position,
(B) The restoring force is always directed towards mean position,
(C) The total energy of the particle is same at every moment of time.
(D) The velocity of the particle is minimum at the mean position.

20. Two waves $y_1 = 0.35\ \sin(316t)$ and $y_2 = 0.35\ \sin(310t)$ are propagating along the same direction. The number of beats produced per second are

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

21. A pipe open at both ends and a pipe closed at one end have save same length. The ratio of frequencies of air columns in their p^{th} overtone respectively is

(A) $\frac{p}{2p+1}$
(B) $\frac{p+1}{2p}$
(C) $\frac{p+1}{2p+1}$
(D) $\frac{2(p+1)}{2p+1}$

22. A uniform metal wire has length ' L ', mass ' M ' and cross-sectional area ' A '. It is under tension ' T ' and ' V ' is the speed of transverse wave along the wire. The density of the wire

(A) $\frac{AT}{V^2}$
(B) $\frac{T}{A^2V}$
(C) $\frac{T}{V^2A}$
(D) $\frac{V^2}{A^2T}$

23. A sonometer wire stretched by weight ' w ' is in unison with a tuning fork. The corresponding resonating length is ' L_1 ' if the weight is increased by ' $3w$ ' the corresponding resonating length of the sonometer in unison tuning fork becomes ' L_2.' . The ratio $\left(\frac{L_1}{L_2}\right)$ is

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

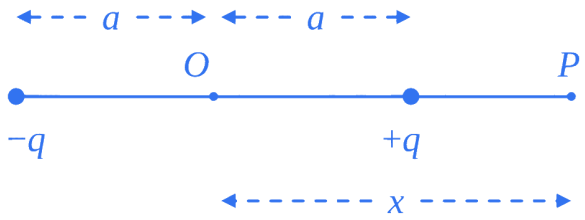
24. Two small identical metal balls are equally charged and placed at a fixed distance away from each other. They experience the electrostatic force ' F ' A similar uncharged ball after touching one of them is placed at the middle point between the two balls. The force experienced by this ball is

(A) $\frac{F}{2}$
(B) F
(C) 4 F
(D) 2 F

25. A spherical conductor of diameter 6 mm is kept in uniform electric field of intensity 2×10^7 N/C. The maximum charge on the conductor is $[\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9$ SI units]

(A) $0.2\mu C$
(B) $2\mu C$
(C) $20\mu C$
(D) $0.02\mu C$

26. An electric dipole is as shown in figure The electric potential at point P due to the dipole is [ϵ_0 = permittivity of free space]

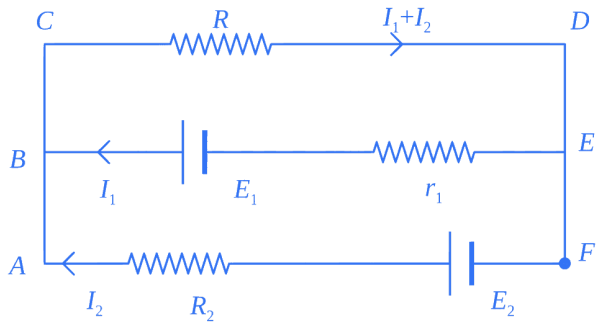


(A) $\frac{aq}{2\pi\epsilon_0(x^2+a^2)}$
(B) $\frac{2aq}{2\pi\epsilon_0(x^2-a^2)}$
(C) $\frac{2aq}{2\pi\epsilon_0(x^2+a^2)}$
(D) $\frac{aq}{2\pi\epsilon_0(x^2-a^2)}$

27. A parallel combination of three condensers of capacities ' 2C, ' C ' and ' C/2 ' is connected Across 10 V battery. All the condensers are fully charged to charges ' Q_1 ', ' Q_2 ' and ' Q 3' respectively. The ratio $Q_1 : Q_2 : Q_3$ is

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

28. An electrical circuit consists of the resistances R, r_1, R_2 and voltage sources E_1 and E_2 as shown in the figure The correct equation for the loop $EBCDE$ is



(A) $E_1 - (I_1 + I_2)R + I_2r_2 = 0$
(B) $E_1 - (I_1 + I_2)R - I_1r_1 = 0$
(C) $E_1 - (I_1 + I_2)R + I_1r_1 = 0$
(D) $E_2 - I_2r_2 - E_1 - I_1r_1 = 0$

29. The resistances in the left and right gap of a balanced metre bridge are 12Ω and 36Ω respectively If the resistances are interchanged the balance point shifts by

(A) 25 cm towards right,
(B) 50 cm towards right,
(C) 25 cm towards left,
(D) 50 cm towards left,

30. Two wires of same length are made to from a circle and a square. They carry same current. The ratio of the magnetic moment of circle to that of square is

(A) $4:\pi$
(B) $2:\pi$
(C) $\pi:4$
(D) $\pi:2$

31. Two thin long parallel wires of same material are separated by a distance ' r ' Both carry same current ' I ' in the direction. Hence they will ($\mu_0 =$ permeability of free space.)

(A) Attract each other with a force $\mu_0 I^{2/2r}$ per unit length
(B) Repel each other with a force $\mu_0 I^2/(2\pi r)$ per unit length
(C) Attract each other with a force $\mu_0 I^2/(2\pi r)$ per unit length.
(D) Repel each other with a force $\mu_0 I^2/(2r)$ per unit length

32. A beam of electrons at rest is accelerated by a potential V. This beam experiences a force F in a uniform magnetic field. The accelerating field is increased to V ' and the force experienced by the electrons in the same field is ' $2F$ ' . The ratio is $\frac{V}{V'}$

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

33. The magnetic flux linked with the coil with time as $\Phi = 4t^2 + 3t + 7$. The magnitude of the induced e.m.f at $t = 2$ s is

(A) 16 V
(B) 29 V
(C) 11 V
(D) 19 V

34. Two coils inductance 1H and 3H are connected series. Their mutual inductance is 5H. The self-inductance of the combination is

(A) 10H
(B) 28H
(C) 14H
(D) 40H

35. When a current of 4 A changes to 8 A in 0.6 s in a primary coil it induces an e. m. f. of 50mV in secondary coil. The mutual inductance between two coils is

(A) 1.2mH
(B) 3.33mH
(C) 7.5mH
(D) 10.5mH

36. In an a. c. circuit the instantaneous current and e.m.f. are represented as $i = i_o \sin\left(\omega t - \frac{\pi}{6}\right)$ and $E = E_o \sin\left(\omega t + \frac{\pi}{3}\right)$ respectively. The voltage leads the current by

(A) $\frac{\pi}{2}$
(B) $\frac{\pi}{4}$
(C) $\frac{\pi}{3}$
(D) $\frac{\pi}{6}$

37. A one microfarad condenser is charged to 50 V. The charging battery is then disconnected and a 10mH coli is connected across the capacitor so that LC oscillations occur. What is the maximum current in the coil? Assume that the circuit contains no resistance.

(A) 0.75 A
(B) 0.25 A
(C) 0.50 A
(D) 1.00 A

38. At resonance, the value of current in a series L-C-R- (Symbols have their usual meanings.)

(A) $\frac{e_0}{R}$
(B) $\frac{e_0}{\sqrt{r^2+\omega^2 C^2}}$
(C) $e_0\left[R^2 + \left(\omega L + \frac{1}{\omega C}\right)^2\right]$
(D) $\frac{e_0}{\sqrt{R^2+\omega^2 L^2}}$

39. When final image is formed at D.D.V from eye, the magnifying power of microscope is (f is the focal length of the lens)

(A) $1 + \frac{f}{D}$
(B) $1 + \frac{D}{f}$
(C) $\frac{D}{f}$
(D) $1 - \frac{D}{f}$

40. If ${}_i\mu_j$ represents refractive index when ray goes from medium i to medium j, then the product ${}_2\mu_1 x {}_3\mu_2 x {}_4\mu_3$ is equal to

(A) $\frac{1}{{}_3\mu_2}$
(B) ${}_3\mu_2$
(C) $\frac{1}{{}_1\mu_4}$
(D) ${}_4\mu_2$

41. In a diffraction pattern, light of wavelength 580 nm is incident normally on a slit of width ' a ' The distance between slit and the screen is 2.5 m and the distance of the second order maximum from the center of the screen is 14.5 mm. The value of ' a ' is

(A) 0.26×10^{-3} m (B) 0.36×10^{-3} m

(C) 0.50×10^{-3} m (D) 0.12×10^{-3} m

42. In Young' double slit experiment, for the n^{th} dark fringe ($n = 1, 2, 3.....$) the phase difference of the interfering waves in radian will be

(A) $(2n-1)\pi$ (B) $(2n+1)\pi$

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

43. In biprism experiment, the wavelength λ is used to obtain an interference pattern. Then fringe width is W_1 at distance D_1 from the screen when the screen is moved towards biprism, fringe width becomes W_2 at distance D_2 The distance between two virtual images of the slit is

(A) $\frac{\lambda(D_2-D_1)}{(W_1-w_2)}$ (B) $\frac{\lambda(W_1-W_2)}{(D_1-D_2)}$

(C) $\frac{\lambda(W_2-W_1)}{(D_1-D_2)}$ (D) $\frac{\lambda(D_1-D_2)}{(W_1-W_2)}$

44. Energy of photon whose frequency is 10^{12}MHz is [Planck's constant, $h = 6.63 \times 10^{-34}$Js, $e = 1.6 \times 10^{-19}$C]

(A) 4.14×10^{3}keV (B) 4.14×10^{2}eV

(C) 4.14×10^{3}MeV (D) 4.14×10^{3}eV

45. The work functions for metals A, B and C are 1.92eV, 2.0eV and 5eV respectively the metal (s) which will emit photoelectrons for incident radiation of wavelength 4100 A is /are

$\left[h = 6.63 \times 10^{-19}\ \text{J}, e = 1.6 \times 10^{-19}\text{C}, c = 3 \times 10^{8}\ \text{m/s}\right]$

(A) Only C (B) B and C

(C) Only A (D) A and B

46. When an electron in hydrogen atom jumps from the fourth Bohr orbit to second Bohr orbit we get the

(A) Second line of Paschen series (B) First line of pfund series

(C) Second line of Balmer (D) First line of Balmer series

47. The half of a radioactive substance is 25 minutes The time between 50% decay and 87.5% decay of the substance will be

(A) 75 min (B) 25 min

(C) 37.5 min (D) 50 min

48. What will be the input of A and B for the Boolean expression $\overline{(A+B)\cdot(A\cdot B)} = 1$

(A) 1,0 (B) 0,0

(C) 0,1 (D) 1,1

49. An n-p-n transistor is biased to work as an amplifier which of the following statements is NOT corrects?

(A) The electrons go from emitter region to base region. (B) The holes go from base region to collector region.

(C) The electrons go from base region to collector region. (D) The electrons go from collector region to base region.

50. Pure Silicon crystal at 300 K has equal electron and hole concentration of $1.5 \times 10^{16}\ \text{m}^{-3}$. Doping by indium increases $n_h = 4.5 \times 10^{22}\ \text{m}^{-3}$. The n_e in the doped silicon is:

(A) 5×10^{9} (B) 2.25×10^{10}

(C) 3×10^{12} (D) 9×10^{6}

51. What is the value of percent atom economy if molar mass of reactants is $36u$ and the mass of product is 27u ?

(A) 75%
(B) 45%
(C) 25%
(D) 50%

52. Which of the following species has highest mass?

(A) 1 g atom of carbon
(B) 3.011×10^{23} atoms of oxygen
(C) 10 mL of water at room temperature
(D) $\frac{1}{2}$ mole of CH_4

53. Which among the following elements develops noble gas configuration in +1 state?

(A) Fr
(B) Ca
(C) Mg
(D) Sr

54. Which among the following statement is TRUE about isotones?

(A) These occupy same positions in the modern periodic table,
(B) These have different number of neutrons and same number of protons.
(C) These have same chemical properties,
(D) The are nuclides having the same number of neutrons but different number of protons and hence different mass numbers.

55. In acetylene molecule, C – H sigma bond is formed by

(A) s - p overlap
(B) sp - s overlap
(C) p – p overlap
(D) sp - sp overlap

56. Which from following molecules has highest bond dissociation enthalph?

(A) Cl_2
(B) I_2
(C) F_2
(D) Br_2

57. Which among the following is NOT odd electron molecule?

(A) CO
(B) NO
(C) NO_2
(D) ClO_2

58. Which among the following is NOT intensive property?

(A) Heat capacity
(B) Viscosity
(C) Pressure
(D) Surface tension

59. Calculate the new volume of a gas at constant pressure when temperature is increased to 546 K [Initial volume of a gas at 273 K is $4dm^3$]

(A) $8dm^3$
(B) $2dm^3$
(C) $4dm^3$
(D) $5dm^3$

60. For the reaction, $C_2H_2OH(l) + 30_{2(g)} \rightarrow 2C_2O(l)\Delta U$ is the heat of reaction at constant volume. Then heat of reaction at constant pressure is

(A) $\Delta H = \Delta U + RT$
(B) $\Delta H = \Delta U + 2RT$
(C) $\Delta H = \Delta U - 2RT$
(D) $\Delta H = \Delta U - RT$

61. What is change in internal energy system does 140KJ of work on surrounding and 40 kJ of heat is added to system?

(A) -200 kJ
(B) -180 kJ
(C) -100 kJ
(D) -280 kJ

62. A weak monoacidic base is 1.2% dissociated in its 0.2M solution. What is the value of dissociation constant?

(A) 1.21×10^{-5}
(B) 1.44×10^{-5}
(C) 2.54×10^{-5}
(D) 2.88×10^{-5}

63. A solution has $[H^+] = 0.001M$. What sis the value of $[OH^-]$

(A) $10^{-2}M$
(B) $10^{-3}M$
(C) 1M
(D) $10^{-11}M$

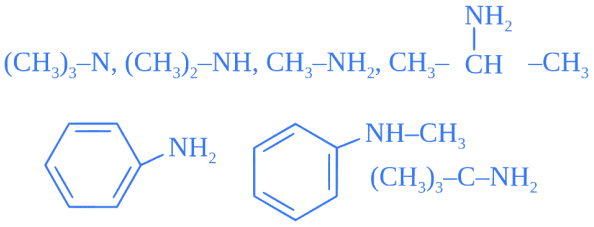
64. The increasing order of PH^H of 0.1M solution of the following compounds is

(A) $HCl < NaCl < NaCN < NH_4NO_3$
(B) $NH_4ON_3 < HCl < NaCl < NaCH$
(C) $BaCN < HClNH_4NO_3 < HCl$
(D) $HCl < NH_4NO_3 < NaCl < NaCN$

65. What is oxidation state of Cl in $KClO_3$

(A) +5
(B) +1
(C) −1
(D) −5

66. What is the number of primary amine molecules among the following compounds?



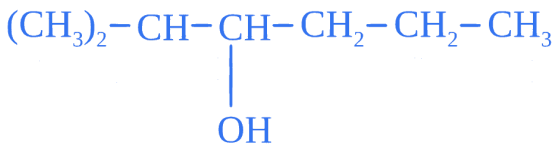
(A) 1 (B) 2
(C) 3 (D) 4

67. What is the IUPAC name of mesityl oxide?

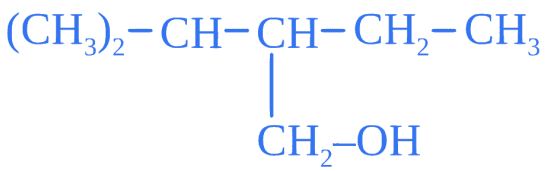
(A) 4-methylpent -oxo-3-en (B) 2-methylpent-4-oxo-ene
(C) 2-methylpent-2-en-4-one (D) 4-methylpent-3-en-2-one

68. Identify secondary alcohol from the following,

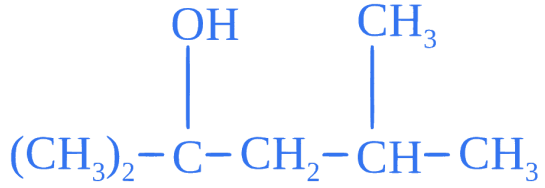
(A) $(CH_3)_2 - CH - CH_2 - CH_2 - OH$



(B)



(C)

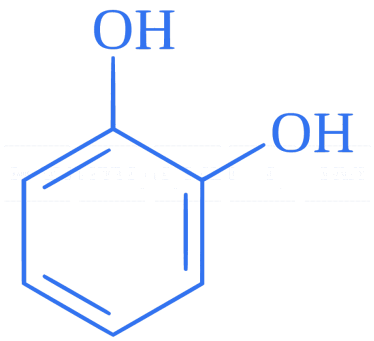


(D)

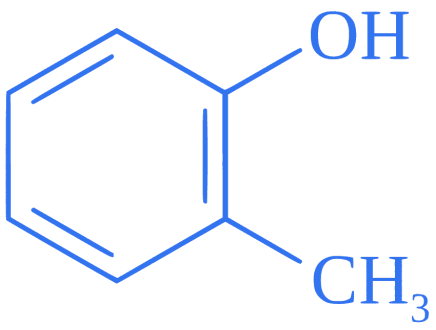
69. Identify functional group present in ethers from following.

(A) $-CHO$ (B) $-O-$
(C) $-NH_2$ (D) $-OH$

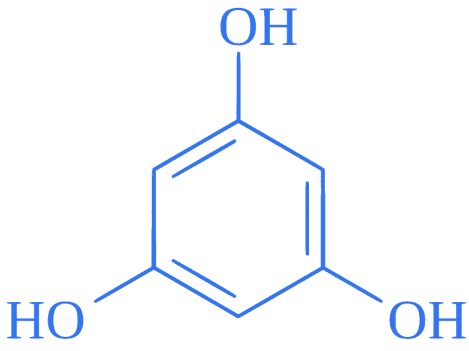
70. Which one among the following is an alcohol?



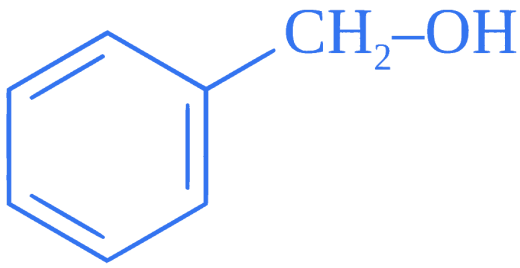
(A)



(B)



(C)



(D)

71. What is the number of π electrons present in pyridine?

(A) 4 (B) 8
(C) 2 (D) 6

72. Identify chiral molecule from the following

(A) $(CH_3)_2 - CH - CH(Cl) - CH - (CH_3)_2$

(B) $CH_3CH(Cl)CH_2CH_3$

(C) $CH_3CH(Cl)CHH_3$

(D) $(CH_3) - C - Cl$

73. Which among the following compounds is an amide?

(A) CH_3CONH_2 (B) CH_3CN

(C) CH_3NH_2 (D) CH_3NO_2

74. Calculate the volume of unit cell of element with density 7.2 g cm^{-3} that forms bcc structure. (288 gram of this element 3.35×10^{24} atoms)

(A) 3.038×10^{23} cm^3 (B) 4.18×10^{23} cm^3

(C) 6.136×10^{23} cm^3 (D) 3.912×10^{23} cm^3

75. What type of bonds are present in molecular crystals?

(A) Metallic bond (B) Ionic bond

(C) Various inter molecular forces of attraction. (D) Covalent bond

76. Which of the following statement is not about ionic solid

(A) The constituent particles of ionic solid are cations and anions. (B) Ionic solids are hard and brittle.

(C) In this constituent particles are held together by electrostatic force of attraction. (D) Pure ionic solid is good conductor of electricity in solid state.

77. Find the freezing point depression of solution having molality 0.25 mol kg^{-1}. ($K_f = 4.0$)

(A) 2.5 K (B) 3.0 K

(C) 2.0 K (D) 1.0 K

78. Find the molar mass of solute when 2 gram dissolved in 60 gram benzene at 30°C and relative lowering of vapour pressure is 0.06 . (Molar mass of benzene is 78 g mol)

(A) 17.4 gram mol^{-1} (B) 35.2 gram mol-1

(C) 43.3 gram mol^{-1} (D) 24.2 gram mol-1

79. Which from the following is NOT a Colligative property?

(A) Freezing point depression. (B) Osmotic pressure.

(C) Vapour pressure by pure benzene. (D) Boiling point elevation.

80. For which of the following electrolyte, kohlrausch law of independent migration of ions is used to calculate molar conductivity at zero concentration?

(A) $NaNO_3$ (B) NH_4OH

(C) KCl (D) Ba_2SO_4

81. The resistance of a conductivity cell containing 0.001M KC1 solution at 300 K is 150Ω. What is the cell constant if conductivity of KCl solution is $1.5 \times 10^{-}\Omega^{-1}$ cm^{-1}

(A) 0.112 cm^{-1} (B) 0.225 cm^{-1}

(C) 0.337 cm^{-1} (D) 0.450 cm^{-1}

82. A conductivity cell has two electrodes 18 mm apart and having cross sectional area 2.0 cm^2. What is value of cell constant?

(A) 0.9 cm^{-1} (B) 0.18 cm^{-1}

(C) 3.6 cm^{-1} (D) 0.2 cm^{-1}

83. Rate of reaction for $2X + Y \rightarrow 3\,W + Z$ is 1.2×10^{-4} $moldm^{-3}$ sec^{-1} when $[X] = [Y] = 0.6$ $moldm^{-3}$ Calculate value of rate constant if reaction is first order in X and zero order in Y

(A) 1.2×10^{-4} $moldm^{-3}sec^{-1}$

(B) 6×10^{-3} $moldm^{-3}$ sec^{-1}

(C) 2×10^{-4} $moldm^{-3}$ sec^{-1}

(D) 1.8×10^{-3} $moldm^{-3}$ sec^{-1}

84. What is the correct relation between rate constant and half-life for zero order reaction

(A) $k = [A]_0 \times t_{1/2}$ (B) $k = \frac{2[A]_0}{t_{1/2}}$

(C) $k = \frac{[A]_0}{t_{1/2}}$ (D) $k = \frac{[A]_0}{2t_{1/2}}$

85. What is rate constant of a first order reaction if time required to decrease concentration of reactant from 1.6M to 0.4M is 12 hours?

(A) 0.116 hour $^{-1}$ (B) 0.167 hour $^{-1}$

(C) 0.4 hour $^{-1}$ (D) 0.78 hour $^{-1}$

86. Which among the following is a negatively charged sol?

(A) CdS (B) $CrO_3 \cdot xH_2O$

(C) $Al_2O_3 \cdot xH_2O$ (D) TiO_2

87. What are the different elements present in mineral barite?

(A) Ca, O, H (B) Ba S, O

(C) Zn, C, O (D) K, N, O

88. Which element from following exhibits common oxidation state $+2$ only?

(A) Cu (B) Co

(C) Sc (D) Zn

89. Which among the following cations forms a most stable complex with the same ligand?

(A) Fe^{2+} (B) Co^{2+}

(C) Mn^{2+} (D) Cd^{2+}

90. Identify the geometry of complex formed when cobalt chloride is dissolved in water

(A) Tetrahedral (B) Square planar

(C) Trigonal bipyramidal (D) Octahedral

91. What type of isomerism is exhibited by $[Co(NH_3)_6][Cr(CN)_6]$ and $[Cr(NH_3)_6][Co(CN)_6]$

(A) Ionization isomerism (B) Linkage isomerism

(C) Coordination isomerism (D) Solvate isomerism

92. Which among the following compounds in used I Swartz reaction?

(A) AgF (B) AgCN

(C) Nal (D) KCN

93. Identify the product A in the following reaction C_2H_5Br+ aq. $KOH \rightarrow A + KBr$

(A) Potassium ethoxide (B) Ethane

(C) Ethanol (D) Ethane

94. Which among the following reagents forms alcohol when reacted with $R - COOH$?

(A) P_2O_5 (B) $NaHCO_3$

(C) NH_3 (D) $LiAlH_4$

95. Which among the following reagents is used in the Rosenmund reduction:

(A) $Zn - Hg/HCl$ (B) $Na - Hg/H_2O$

(C) H_2/Pt at 473 K (D) $H_2/Pd - BaSO_4$

96. Which of the following conversions need the reagent Sn/HCl ?

(A) $R - CO - NH_2 \rightarrow R - CH_2 - NH_2$

(B) $R - C \equiv N \rightarrow R - CH_2 - NH_2$

(C) $R - NO_2 \rightarrow R - NH_2 + 2H_2O$

(D) $R - CO - HN_2 \rightarrow R - NH_2$

97. Which among the following carbohydrate molecules yields highest number of galactose molecules when one mole of each is hydrolyzed?

(A) Sucrose (B) Stachyose

(C) Raffinose (D) Lactose

98. What is the number of primary and secondary alcoholic groups respectively present in glucose?

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

(C) 4,2 (D) 1,4

99. Which among the following polymers restores it's original shape once stretched?

(A) Neoprene (B) Bakelite

(C) Polythene (D) Nylon 6

100. Identify the monomer for synthesis of polyacrylonitrile.

(A) CH_2CHCl (B) C_2H_4

(C) C_2F_4 (D) CH_2CHCN

101. If $f(x) = e^{|x|}, g(x) = \log x$, then $(g \text{ of })(x) =$

(A) $|x|$ (B) 1

(C) $2x$ (D) $-x^2$

102. The number of values of x in the interval $[0, 3\pi]$ satisfying $2\sin^2 x + 5\sin x - 3 = 0$ is

(A) 1 (B) 6

(C) 4 (D) 2

103. The value of $4\cos^3 20^\circ$ is

(A) $-\frac{1}{2} - \cos 20^\circ$ (B) $-\frac{1}{2} + 3\cos 20^\circ$

(C) $\frac{1}{2} + 3\cos 20^\circ$ (D) $\frac{1}{2} - 3\cos 20^\circ$

104. The value of $\cos^{-1}\left(\tan\left(\frac{7\pi}{4}\right)\right)$ is

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

(C) π (D) $\frac{2\pi}{3}$

105. If α and β are imaginary cube roots of units then value of $\alpha^4 + \beta^{28} + \frac{1}{\alpha\beta}$ is

(A) 1 (B) 0

(C) -1 (D) 2

106. If the lines $4x + 3y - 1 = 0, x - y + 5 = 0$ and $kx + 5y - 3 = 0$ are concurrent, then $k =$

(A) 5 (B) 6

(C) 7 (D) 4

107. If the slope of one of the two lines $\frac{x^2}{a} + \frac{2xy}{h} + \frac{y^2}{b} = 0$ is twice that of the other, then $ab : h^2 =$

(A) 8:9 (B) 9:8

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

108. The combined equation of the lines passing through the origin making an acute angle α with the line $y = x$ is

(A) $x^2 - 2xy\tan 2 \propto +y^2 = 0$

(B) $x^2 - 2xy\sec 2 \propto +y^2 = 0$

(C) $x^2 + 2xy\sec 2\alpha + y^2 = 0$

(D) $x^2 + 2xy\tan 2\alpha + y^2 = 0$

109. Angle between the tangents to the circle $x^2 + y^2 = 25x^2$ from the point $(1, 7)$ is

(A) $\frac{\pi}{4}$ (B) $\tan^{-1}\left(\frac{2}{5}\right)$

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

110. $\lim_{x\to 0} \frac{2x}{|x|+x^2} =$

(A) Limit exists (B) Limit does not exists

(C) 2 (D) -2

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

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

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

112. Let A, B, C and D be four nonempty sets. The contrapositive of 'if $A \subseteq B$ and $B \subseteq D$ then $A \subseteq C$ ' is

(A) If $A \nsubseteq C$, then $A \nsubseteq B$ or $B \nsubseteq D$ (B) If $A \subset C$, then $A \subseteq B$ and $B \subseteq D$

(C) If $A \subseteq C$, then $A \subseteq B$ and $B \subseteq D$ (D) If A $\subseteq C$, then B $\subset$ A or D $\subset$ B

113. The variance of first 10 multiples of 3 is

(A) 74.15 (B) 73.15

(C) 74.25 (D) 70.15

114. $2\tan^{-1}\left(\frac{1}{3}\right) + \cos^{-1}\left(\frac{3}{5}\right) =$

(A) $\frac{\pi}{4}$ (B) 0

(C) $\tan^{-1}\left(\frac{5}{4}\right)$ (D) $\frac{\pi}{2}$

115. If $A = \begin{bmatrix} 3 & 2 \\ 0 & 1 \end{bmatrix}$, then $\left(A^{-1}\right)^3 =$

(A) $\frac{1}{27}\begin{bmatrix} -1 & 26 \\ 0 & 27 \end{bmatrix}$ (B) $\frac{1}{27}\begin{bmatrix} 1 & -26 \\ 0 & -27 \end{bmatrix}$

(C) $\frac{1}{27}\begin{bmatrix} 1 & -26 \\ 0 & 27 \end{bmatrix}$ (D) $\frac{1}{27}\begin{bmatrix} 1 & 26 \\ 0 & -27 \end{bmatrix}$

116. If $\begin{bmatrix} 1 & 1 & 1 \\ 1 & -2 & -2 \\ 1 & 3 & 1 \end{bmatrix}\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 0 \\ 3 \\ 4 \end{bmatrix}$, then $2x - y + z =$

(A) 3 (B) 2

(C) 1 (D) -3

117. If $A = \begin{bmatrix} 1 & -1 & 1 \\ 2 & -1 & 0 \\ 3 & 3 & -4 \end{bmatrix}$, adj $A = \begin{bmatrix} 4 & -1 & 1 \\ 8 & -7 & a \\ 9 & -6 & b \end{bmatrix}$, then

(A) $a = 2, b = -1$ (B) $a = 2, b = 1$

(C) $a = -2, b = 1$ (D) $a = 1, b = -2$

118. If $f(x) = \frac{e^{x^2} - \cos x}{x^2}$ if $x \neq 0$ is continuous at $x = 0$, then $f(0) =$.

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

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

119. If $y = \tan^{-1}\left(\frac{4x}{1+5x^2}\right) + \tan^{-1}\left(\frac{3+8x}{3-3x}\right)$, then $\frac{dy}{dx} =$

(A) $\frac{1}{1+25x^2}$ (B) $\frac{5}{1+25x^2}$

(C) $\frac{1}{1+5x^2}$ (D) $\frac{5}{1+5x^2}$

120. If $y = \sin^{-1}\left(\frac{5x+12\sqrt{1-x^2}}{13}\right)$, then $\frac{dy}{dx} =$

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

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

121. If $e^x + e^y = e^{x+y}$, then $\frac{dy}{dx} =$

(A) $-e^{y-x}$ (B) e^{x-y}

(C) $-e^{x-y}$ (D) e^{y-x}

122. Two positive numbers x and y such that $(x + y) = 60$ and xy^3 is maximum, then the numbers are respectively

(A) 45,15 (B) 30,30

(C) 20,40 (D) 40,20

123. If $f(x) = \frac{x}{\log x}$, then $f(x)$ is increasing in

(A) $(0, \infty)$ (B) (e, ∞)

(C) $(-\infty, 0)$ (D) [e, ∞)

124. The rate of disintegration of a radio active element at time t is proportional to its mass at that time. Then the time during which the original mass of 6gm will disintegrate into its mass of 3gm is proportional to

(A) $\log 4$ (B) $\log 3$

(C) $\log 5$ (D) $\log 2$

125. $\int (x-a)\left(x^{n-1} + x^{n-2}a + \ldots.. + a^{n-1}\right) dx =$ (where C is a constant of integration)

(A) $\frac{x^{n+1}}{n+1} - a^n x + C$ (B) $x^n - a^n + C$

(C) $\frac{x^{n+1}}{n+1} - a^n + C$ (D) $na^{n-1} + C$

126. $\int_0^{\frac{\pi}{2}} \frac{dx}{5+4\cos x} =$

(A) $\frac{1}{3}\tan^{-1}\left(\frac{1}{3}\right)$ (B) $2\tan^{-1}\left(\frac{1}{3}\right)$

(C) $\frac{2}{3}\tan^{-1}\left(\frac{1}{3}\right)$ (D) $\tan^{-1}\left(\frac{1}{3}\right)$

127. $\int \frac{\sin^8 x - \cos^8 x}{1 - 2\sin^2 x \cos^2 x}$ (where C is constant of integration.)

(A) $-2\sin(2x) + C$ (B) $\frac{1}{2}\cos(2x) + C$

(C) $2\cos(2x) + C$ (D) $-\frac{1}{2}\sin(2x) + C$

128. $\int (3-x)\sqrt{4-x}dx =$ (Where C is a constant of integration.)

(A) $\frac{2}{3}(4-x)^{3/2} + \frac{2}{5}(4-x)^{5/2} + C$

(B) $-\frac{2}{5}(4-x)^{5/2} + \frac{2}{3}(4-x)^{3/2} + C$

(C) $\frac{2}{3}(4-x)^{3/2} - \frac{2}{5}(4-x)^{5/2} + C$

(D) $\frac{2}{5}(4-x)^{5/2} - \frac{2}{5}(4-x)^{3/2} + C$

129. $\int_0^1 \sqrt{\frac{1-x}{1+x}}dx =$

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

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

130. The angle between the curves $y = \sin x$ and $y = \cos x 0 < x < \frac{\pi}{2}$, is

(A) $\tan^{-1}(\sqrt{2})$ (B) $\tan^{-1}(3\sqrt{2})$

(C) $\tan^{-1}(2\sqrt{2})$ (D) $\tan^{-1}(3\sqrt{3})$

131. Area of the region bounded by the curve $y = x^2 + 2$ and the lines $y = x, x = 0$ and $x = 3$ is

(A) $\frac{19}{2}$ sq $\cdot$ units (B) $\frac{21}{2}$sq$\cdot$ units

(C) $15sq\cdot$ units (D) $\frac{9}{2}$sq $\cdot$ units

132. The differential equation $x^2(y+1)dx + y^2(x-1)dy = 0$ has the general solution given by (where C is a constant of integration.)

(A) $(x-1)^2 + (y-1)^2 + 2\log[(x+1)(y+1)] = C$

(B) $(x-1)^2 + (y+1)^2 + 2\log[(x+1)(y-1)] = C$

(C) $(x+1)^2 + (y+1)^2 + 2\log[(x-1)(y+1)] = C$

(D) $(x+1)^2 + (y-1)^2 + 2\log[(x-1)(y+1)] = C$

133. The general solution of differential equation $xdy - ydx = 0$ represents

(A) the circle whose centre is at the origin
(B) a straight line passing through the origin
(C) a rectangular hyperbola
(D) the parabola whose vertex is at the origin.

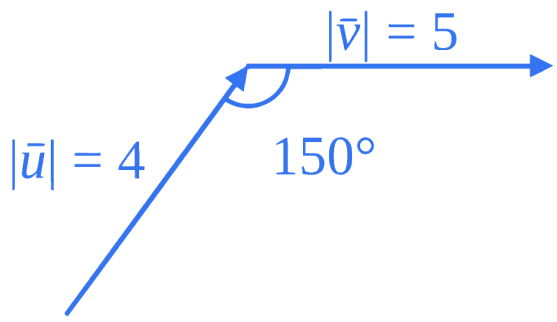
134. The particular solution of $\frac{dy}{dx} = 1 + x + y^2 + xy^2$, when $y(0) = 0$. is

(A) $y = \log\left(1 + \frac{x^2}{2}\right)$
(B) $y^3 = \log\left(1 + \frac{x^2}{2}\right)$
(C) $y^2 = \tan\left(1 + \frac{x^2}{2}\right)$
(D) $y = \tan\left(x + \frac{x^2}{2}\right)$

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

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

136. If $\bar{u}, \bar{v}$ are two vectors represented in the following figure, then the value of $|\bar{u} \times \bar{v}| =$



(A) 20
(B) $10\sqrt{3}$
(C) 10
(D) $5\sqrt{3}$

137. A vector with magnitude of 3 units, which is perpendicular to each of the vectors $\bar{a} = 3\hat{i} + \hat{j} - 4\hat{k}$ and $\bar{b} = 6\hat{i} + 5\hat{j} - 2\hat{k}$, is given by

(A) $\pm(2\hat{i} - 2\hat{j} + \hat{k})$
(B) $\pm(2\hat{i} + 2\hat{j} - \hat{k})$
(C) $\pm(2\hat{i} - 2\hat{j} - \hat{k})$
(D) $\pm(2\hat{i} + 2\hat{j} + \hat{k})$

138. If $|\bar{a}| = \sqrt{26}, |\bar{b}| = 7$ and $|\bar{a} \times \bar{b}| = 35$, then $\bar{a} \cdot \bar{b} =$

(A) $\pm 5\sqrt{26}$
(B) $\pm\sqrt{26}$
(C) ± 7
(D) $\pm 7\sqrt{26}$

139. If $|\bar{a}| = 3, |\bar{b}| = 5$ and $|\bar{c}| = 7$ and $\bar{a} + \bar{b} + \bar{c} = \bar{0}$, then the angle between $\bar{a}$ and $\bar{b}$ is

(A) $\frac{\pi}{4}$
(B) $\frac{\pi}{2}$
(C) $\frac{\pi}{3}$
(D) $\frac{\pi}{6}$

140. The volume of the tetrahedron having vertices $(1, -6, 10)$, $(-1, -3, 7), (5, -1, \lambda)$ and $(7, -4, 7)$ is 11cu. Units, then $\lambda =$

(A) 3
(B) 1
(C) 5
(D) 7

141. The direction cosines of the line which is perpendicular to the lines $\frac{x-7}{2} = \frac{y+17}{-3} = \frac{z-6}{1}$ and $\frac{x+5}{1} = \frac{y+3}{2} = \frac{z-6}{-2}$ are

(A) $\pm\frac{3}{\sqrt{50}}, \pm\frac{4}{\sqrt{50}}, \pm\frac{5}{\sqrt{50}}$
(B) $\pm\frac{4}{\sqrt{90}}, \pm\frac{5}{\sqrt{90}}, \pm\frac{7}{\sqrt{90}}$
(C) $\pm\frac{4}{\sqrt{29}}, \pm\frac{3}{\sqrt{29}}, \pm\frac{2}{\sqrt{29}}$
(D) $\pm\frac{1}{\sqrt{26}}, \pm\frac{3}{\sqrt{26}}, \pm\frac{4}{\sqrt{26}}$

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

(A) $\vec{r} \cdot (-5\hat{i} + 4\hat{j} + \hat{k}) = 7$
(B) $\vec{r} \cdot (-5\hat{i} + 4\hat{j} - \hat{k}) = -7$
(C) $\vec{r} \cdot (-5\hat{i} + 4\hat{j} + \hat{k}) = -7$
(D) $\vec{r} \cdot (-5\hat{i} + 4\hat{j} - \hat{k}) = 7$

143. The angle between the lines $\bar{r} = (\hat{i} + 2\hat{j} + 3\hat{k}) + \lambda(2\hat{i} - 2\hat{i} + \hat{k})$. and $\bar{r} = (\hat{i} + 2\hat{j} + 3\hat{k}) + \lambda(2\hat{i} + 2\hat{i} + \hat{k})\hat{i} + 2j + k$

(A) 90°
(B) 0°
(C) 30°
(D) 60°

144. The length of the perpendicular from the origin to the plane $\bar{r}.\ (3\hat{i} - 4\hat{j} + 12\hat{k}) = 8$ is

(A) 8 units
(B) $\frac{13}{8}$
(C) $\frac{8}{13}$
(D) 13 units

145. The maximum value of $z = 50x + 15y$ subject to the constraints $x + y \leq 60; 5x + y \leq 100; x \geq 0; y \geq 0$ is at the point

(A) $2650, (50, 10)$
(B) $1000, (20, 0)$
(C) $900, (0, 60)$
(D) $1250, (10, 50)$

146. Following is the probability distribution of smart phones sold in a shop per day

Number of smart phones	0	1	2	3	4	5
Probability	k	0.3	0.15	0.15	0.1	$2k$

Then $E(x) =$

(A) 2.45 (B) 2.55

(C) 0.55 (D) 0.75

147. A family with three children is chose at random. The probability that the oldest and youngest children are of the same gender is

(A) $\frac{3}{8}$ (B) $\frac{1}{2}$

(C) $\frac{1}{8}$ (D) $\frac{2}{8}$

148. A random variable X assumes value $1, 2, 3, \ldots\ldots n$ with equal probabilities. If the ratio of variance of $= \sum p_i x_i^2 - (\sum p_i x_i)^2$ to expected value of X is equal to 4 , then the value of n is

(A) 35 (B) 50

(C) 30 (D) 25

149. If $X \sim B\left(8, \frac{1}{2}\right)$, then $P(|x-4| \leq 2) =$

(A) $\frac{119}{128}$ (B) $\frac{117}{128}$

(C) $\frac{1}{n}$ (D) $\frac{116}{128}$

150. A bag contains 5 red marbles, 4 black marbles and 3 white marbles. Then the number of ways in which 4 marbles can be drawn so that at most 2 of them are red is

(A) 385 (B) 406

(C) 210 (D) 420

- End of Question Paper -