MHT CET 2022 PCM Aug 11 Shift 1 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. According to Boyle's law the product PV remain constant. The dimension of PV is same as

(A) Energy (B) Force
(C) Impulse (D) Momentum

2. A body covers half of its distance with speed u and the other half with a speed v, the average speed of the body is

(A) $\frac{2uv}{u+v}$ (B) $\frac{u-v}{2}$
(C) $\frac{u+v}{2uv}$ (D) $\frac{u+v}{2}$

3. In non-uniform circular motion, the ratio of tangential to radial acceleration is (r is radius of circle, v is speed of the particle, α is angular acceleration)

(A) $\frac{\alpha r^2}{v^2}$ (B) $\frac{\alpha^2 r}{v^2}$
(C) $\frac{\alpha^2 r^2}{v}$ (D) $\frac{v^2}{r^2\alpha}$

4. Three bodies each of mass 1 kg are situated at the vertices of an equilateral triangle of side 1 m. The xy-coordinates of centre of mass of the system are.

(A) $\left(\frac{1}{2\sqrt{3}}, \frac{1}{2\sqrt{3}}\right)$ (B) $\left(\frac{1}{2\sqrt{3}}, \frac{1}{2}\right)$
(C) $\left(\frac{1}{2}, \frac{1}{2}\right)$ (D) $\left(\frac{1}{2}, \frac{1}{2\sqrt{3}}\right)$

5. A ring, a solid sphere and a disc have same mass and radius. Which of them have the largest moment of inertia?

(A) All have the same moment of inertia (B) Solid sphere only
(C) Ring only (D) Disc only

6. A body of mass m is dropped from a height $\frac{R}{2}$, from the surface of earth where R is radius of earth. Its speed when it will hit the earth's surface is (v_e = escape v elocity from earth' surface)

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

7. The height above the surface of the earth where acceleration due to gravity becomes $\left(\frac{g}{9}\right)$ is (R is radius of the earth, g is acceleration due to gravity)

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

8. The radii of two mercury drops are R_1 and R_2. Under isothermal conditions, a single drop of radius R is formed from them. The relations between R, R_1 and R_2 is

(A) $R^2 = R_1^2 + R_2^2$ (B) $R = R_1 + R_2$
(C) $R = \frac{R_1+R_2}{2}$ (D) $R^3 = R_1^3 + R_2^3$

9. A can filled with water is revolved in a vertical circle of radius r with constant speed and water just does not fall down. The time period of revolution is (g = acceleration due to gravity)

(A) $2\pi\sqrt{rg}$ (B) $2\pi\sqrt{5rg}$
(C) $2\pi\sqrt{\frac{r}{g}}$ (D) $2\pi\sqrt{\frac{g}{r}}$

10. The work done in blowing a soap bubble of radius R is W_1 and that of radius $2R$ is W_2. The ratio of W_1 to W_2 is

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

11. Heat energy is incident on the surface at the rate of 1000 J/ min. If coefficient of absorption is 0.8 and coefficient of reflection is 0.1 , then heat energy transmitted by the surface in 5 minute is

(A) 700 J (B) 500 J
(C) 100 J (D) 900 J

12. The volume of a metal sphere increases by 0.30%, when its temperature is raised by 50°C. The coefficient of linear expansion of the metal is

(A) $6 \times 10^{-5/^\circ}\text{C}$ (B) $3 \times 10^{-5/^\circ\text{C}}$
(C) $2 \times 10^{-5/^\circ\text{C}}$ (D) $12 \times 10^{-5/^\circ}\text{C}$

13. In an adiabatic process, the state of a gas is changed from P_1, V_1, T_1 to P_2, V_2, T_2. Out of the following relations, the correct one is

(A) $T_1V_1^{\gamma-1} = T_2V_2^{\gamma-1}$ (B) $P_1T_1^{\gamma} = P_2T_2^{\gamma}$
(C) $T_1V_1^{\gamma} = T_2V_2^{\gamma}$ (D) $P_1V_1^{\gamma-1} = P_2V_2^{\gamma-1}$

14. In a thermodynamic system, working substance is an ideal gas. Its internal energy is in the form of

(A) neither kinetic nor potential energy (B) both kinetic and potential energy
(C) only potential energy (D) only kinetic energy

15. The temperature of an ideal gas is increased from 140 K to 560 K. If the r.m.s. speed of gas molecules is v at 140 K, then at 560 K, r.m.s. speed becomes

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

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

16. The force constant of an oscillating simple pendulum is

(A) Independent of mass of the bob as well as length of the pendulum

(B) Inversely proportional to mass of the bob and length of the pendulum

(C) Directly proportional to the mass of the bob

(D) Directly proportional to length of the bob

17. The path length of oscillation of simple pendulum of length 1 m is 16 cm. its maximum velocity is (Take $g = \pi^2$ m/s^2)

(A) 2πcm/s (B) 8πcm/s

(C) 4πcm/s (D) 16πcm/s

18. The period of oscillation of a second's pendulum on the planet whose mass and radius are twice that of earth will

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

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

19. At what temperature will the speed of sound be nearly 1.5 times its value at N.T.P.?

(A) 136°C (B) 614°C

(C) 341°C (D) 409°C

20. In resonance tube experiment, the first and second resonance are heard when water level is 24.1 cm and 74.1 cm respectively, below the open end of the tube. The inner diameter of the tube is

(A) 3 cm (B) 2 cm

(C) 5 cm (D) 4 cm

21. A standing wave with number of loops is produced on a string fixed at both ends. Which one of the following statements is correct?

(A) All particles vibrate in phase.

(B) Particles between two consecutive antinodes vibrate in phase.

(C) The particles at alternate antinodes vibrate in phase.

(D) The particles at all antinodes vibrate in phase.

22. Two waves of same frequency n are approaching each other with same velocity, $v = 20$ m/s and interfere. The distance between two consecutive nodes is

(A) $\frac{20}{n}$ (B) $\frac{10}{n}$

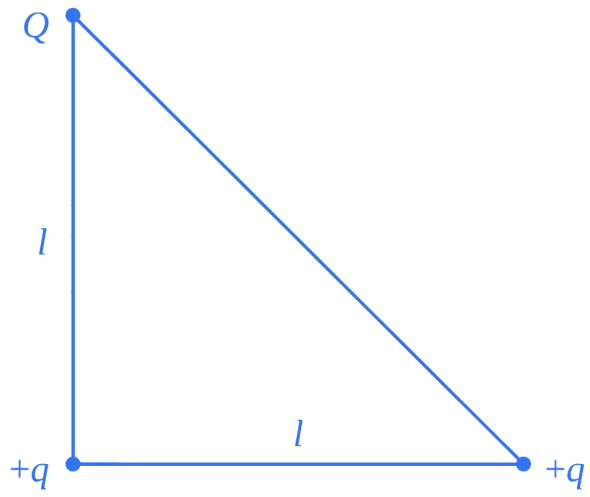
(C) $\frac{5}{n}$ (D) $\frac{n}{10}$

23. Three charges q, Q and $+4q$ are placed in a straight line of length d at points at distances $0, \frac{d}{2}$ and d respectively. In order to make the net force on q to be zero, the value of Q should be

(A) $-2q$ (B) $\frac{-q}{2}$

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

24. Three charges $Q, +q$ and $+q$ are placed at the vertices of right-angle triangle as shown. The net electrostatic energy of the configuration is zero. The value of Q is



(A) $-2q$ (B) $-\frac{q}{1+\sqrt{2}}$

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

25. Initially n identical capacitors are joined in parallel and are charged to potential V. Now they are separated and joined in series. Then

(A) Potential difference becomes nV and energy remains the same.

(B) potential difference is nV and energy increases n times

(C) potential difference total energy of combination remains same

(D) potential difference remains the same and the energy increases n times.

26. In a parallel plate air capacitor of plate separation d, a dielectric slab of thickness t is introduced between the plates $(t < d)$. The capacitance becomes one-third of the original value. The dielectric constant of the slab will be

(A) $\frac{t}{2d+t}$

(B) $\frac{t}{d-2t}$

(C) $\frac{t}{d+t}$

(D) $\frac{2t}{2d-t}$

27. The current associated with an electron of charge e moving in a circular orbit of radius r with speed v around the positively charged nucleus is given by

(A) $\frac{er}{2\pi v}$

(B) $\frac{e\pi}{2rv}$

(C) $\frac{ev}{\pi r}$

(D) $\frac{ev}{2\pi r}$

28. Water rises to a height of 20 mm in a capillary tube of cross-sectional area A. If the area of cross-section of the tube is made $\left(\frac{A}{4}\right)$, then water will rise to a height of

(A) 2 cm

(B) 6 cm

(C) 4 cm

(D) 3 cm

29. In a potentiometer experiment, the null point is obtained on 7^{th} wire for given cell. To shift the null point on 9^{th} wire for the same cell what should we do?

(A) Decrease applied e.m.f.

(B) Increase resistance in main circuit

(C) Attach resistance in series with a cell

(D) Decrease resistance in main circuit

30. A galvanometer of resistance G can be converted into a voltmeter of range V by connecting a resistance R in series with it. The series resistance required to change its range to $\frac{V}{3}$ is

(A) $\frac{R-3G}{4}$

(B) $\frac{R+G}{3}$

(C) $\frac{R-G}{2}$

(D) $\frac{R-2G}{3}$

31. A long wire carries a steady current. It is bent into a coil of one turn such that magnetic induction at centre is B, then same wire is bent to from a coil of smaller radius of n turns such that magnetic induction at centre is B, then

(A) $B' = B/n^2$

(B) $B' = nB$

(C) $B' = B$

(D) $B' = n^2B$

32. A current carrying circular coil of radius R has a point P situated on its axis at a distance x from its centre O of the coil. The magnetic induction at point P is $\left(\frac{1}{8}\right)^{\text{th}}$ of magnetic field at its centre O. The value of x is

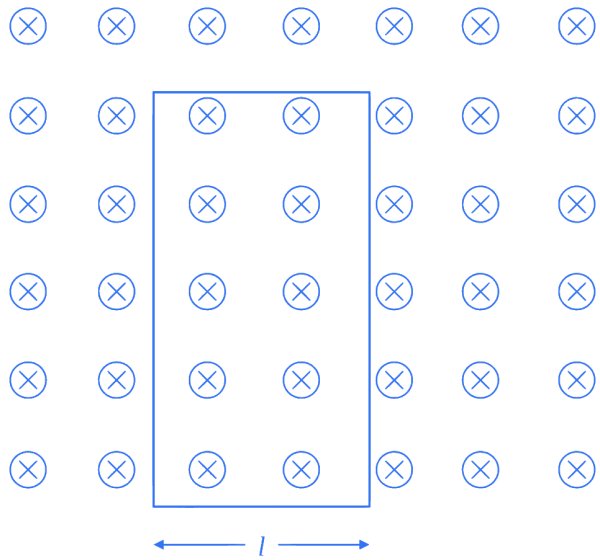
(A) $\frac{R}{2\sqrt{3}}$

(B) $\sqrt{3}R$

(C) $\frac{R}{\sqrt{3}}$

(D) $\frac{2}{\sqrt{3}}R$

33. A long, rectangular conducting loop of width l mass m and resistance R is placed partly in a perpendicular magnetic field B. It is pushed downwards with velocity v so that it may continue to fall freely. The velocity v is (g = acceleration due to gravity)



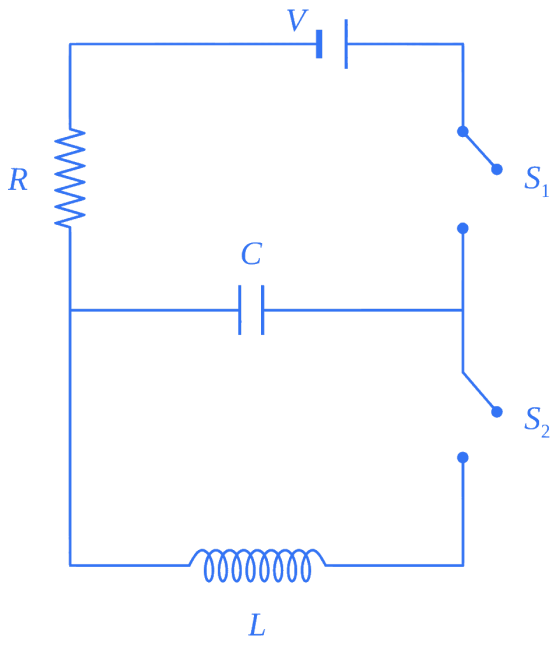
(A) $\frac{mgR^2}{Bl}$

(B) $\frac{mgR}{B^2l^2}$

(C) $\frac{mgl}{B^2R^2}$

(D) $\frac{B^2l^2R}{mg}$

34. In the given circuit, when S_1 is closed, the capacitor C gets full charged. Then S_1 is kept open and S_2 is closed. Hence



(A) The current in the circuit is in the same direction.

(B) The instantaneous current in the circuit may be $V\sqrt{\frac{C}{L}}$.

(C) The energy stored in the circuit is purely in the form of magnetic energy.

(D) There is no exchange of energy between inductor L and capacitor C.

35. An air-cored solenoid with length 30 cm, area of cross-section 25 cm^2 and number of turns 500 carries a current of 2.5 A. The current is suddenly switched off for a brief time of 10^{-3} s. How much is the (nearly) average back e.m.f. induced across the ends of the open switch in the circuit? (Ignore the variation of magnetic field near the ends of solenoid)

(A) 4.2 V

(B) 6.5 V

(C) 7.3 V

(D) 9 V

36. An AC voltage source of variable angular frequency ω and fixed amplitude V_0 is connected in series with a capacitance C and an electric bulb of resistance R (inductance zero). When ω is increased

(A) Total impedance of the circuit increase.

(B) The bulb glows brighter.

(C) The bulb glows dimmer.

(D) Total impedance of the circuit is unchanged.

37. A transformer having efficiency of 90% is working on 200 V and 3 kW power supply. If the current is the secondary coil is 6 A, the voltage across the secondary coil and the current in the primary coil respectively are

(A) 450 V , 12 A

(B) 600 V , 15 A

(C) 300 V , 15 V

(D) 450 V , 15 A

38. A resistor R, an inductor L and a capacitor C are connected in series to an oscillator of frequency N. If the resonance frequency is N_R, then the current lags behind voltage, when

(A) $N = N_R$

(B) $N = 0$

(C) $N < N_R$

(D) $N > N_R$

39. A beam of white light is partially reflected and partially refracted from a surface. The angle between the reflected and refracted light is 90°. The angle of refraction is 30°. The angle of incidence must be

(A) 70°

(B) 60°

(C) 55°

(D) 58°

40. The ratio of the total energy of the 2^{nd} orbit electron for the hydrogen atom $\left({}_1H^1\right)$ to that of helium ion (H_e^+) $\left[\left({}_2^4\text{He}\right)\right]$ is

(A) 4

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

(C) 2

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

41. A bubble in a glass slab (refractive index1.5) when viewed from one side appears at 5 cm and at 2 cm from other side then thickness of the slab is

(A) 2.5 cm

(B) 3 cm

(C) 10.5 cm

(D) 3.75 cm

42. Consider the following statements about interference of light A. The interference fringes are equally bright and equally spaced B. At the centre of a bright fringe, the intensity is four times the intensity of the incident wave C. For constructive interference of two waves, the crest of one wave coincides with trough of another wave. Which of the above statements are correct?

(A) A and B only (B) A and C only
(C) All A, B and C (D) B and C only

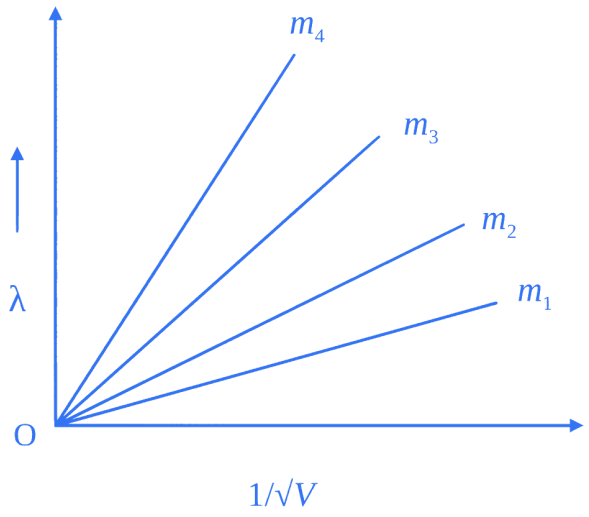
43. In Young's double slit experiment, the slit separation is made threefold by keeping remaining setup same, the fringe width becomes

(A) $\frac{1}{9}$ times (B) $\frac{1}{3}$ times
(C) 9 times (D) 3 times

44. A thin transparent plate of thickness t and refractive index μ is introduced in the path of one of the two interfering waves. The path difference between these waves is changed by half the wavelength of light λ. The thickness of the plate is

(A) $\frac{\lambda}{4(\mu-1)}$ (B) $\frac{3\lambda}{4(\mu-1)}$
(C) $\frac{\lambda}{(\mu-1)}$ (D) $\frac{\lambda}{2(\mu-1)}$

45. Graph shows the variation of de-Broglie wavelength λ versus $\frac{1}{\sqrt{V}}$ where V is the accelerating potential for four particles, P, Q, R, S carrying same charge but of mass m_1, m_2, m_3, m_4. Which one represents a particle of smaller mass?



(A) m_4 (B) m_1
(C) m_3 (D) m_2

46. In photoelectric effect, the kinetic energy of electron emitted from the metal surface depends upon

(A) intensity of incident light (B) both intensity and velocity of incident light
(C) frequency of incident light (D) velocity of incident light

47. Activity of a radioactive sample decreases to $\left(\frac{1}{3}\right)^{rd}$ of its original value in 3 days. Then in 9 days its activity reduces to

(A) $\left(\frac{1}{18}\right)$ of the original value (B) $\left(\frac{1}{9}\right)$ of the original value
(C) $\left(\frac{1}{27}\right)$ of the original value (D) $\left(\frac{1}{3}\right)$ of the original value

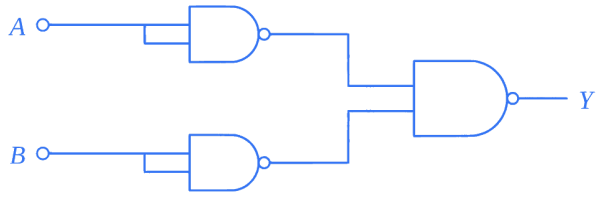
48. In the common emitter mode of a transistor when the collector emitter voltage is changed by 0.4 V, the collector current changes by 0.04 mA. The output resistance is

(A) 20kΩ (B) 10kΩ
(C) 5kΩ (D) 1kΩ

49. Reverse bias applied to a $p-n$ junction diode

(A) increases the minority charge carriers. (B) lowers the potential barrier.
(C) decreases the majority charge carriers. (D) raises the potential barrier.

50. The combination of logic gates shown below becomes



(A) X-OR gate (B) NAND gate
(C) NOR gate (D) OR gate

collegedunia

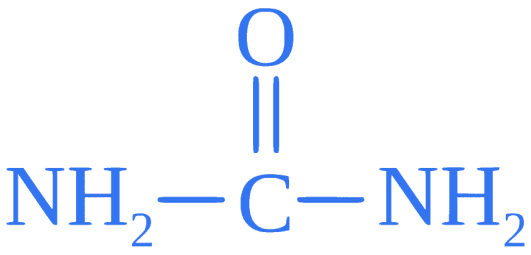
51. What is the number of CO_2 molecules in 45.42 litre at STP? (Consider molar volume of gas at STP $= 22.71\ L\ mol^{-1}$)

(A) 0.913×10^{24} (B) 1.806×10^{24}
(C) 1.501×10^{24} (D) 1.204×10^{24}

52. What is the quantity of sugar charcoal remaining behind after charring 17.1 g sugar using conc. H_2SO_4 under ideal conditions?

(A) 7.2 g (B) 14.4 g
(C) 10.5 g (D) 11.4 g

53. Find the number of hydrogen atoms present in 6.0 g of



(A) 2.4×10^{23} (B) 4.06×10^{23}
(C) 2.16×10^{23} (D) 3.01×10^{23}

54. What is the relation between molality of the solution and molar mass of solute?

(A) $m = \frac{M_2\ W_2}{1000\ W_1}$ (B) $m = \frac{1000\ W_2}{M_2\ W_1}$
(C) $m = \frac{1000\ W_1}{M_2\ W_2}$ (D) $m = \frac{M_2\ W_1}{1000\ W_2}$

55. What is the relations between radius, of order orbit and nuclear charge for hydrogen like species?

(A) $r_n = \frac{a_0 n^2}{z} pm$ (B) $r_n = \frac{a_0 n^2}{z^2} pm$
(C) $r_n = \frac{a_0 n}{n^2} pm$ (D) $r_n = \frac{a_0 z}{n^2} pm$

56. What is $\angle HOH$ in H_2O molecule?

(A) $109°28'$ (B) $104°28'$
(C) $107°$ (D) $120°$

57. Identify the molecule containing triple bond.

(A) Ammonia (B) Dinitrogen
(C) Water (D) Methane

58. An ideal gas is allowed to expand from $2dm^3$ to $6 \times 10^{-3}\ m^3$ against a constant external pressure of 1 bar. The work done in kJ is

(A) -6.0 kJ (B) -0.4 kJ
(C) -4.0 kJ (D) -2 kJ

59. If a system absorbs 30 kJ of heat and perform 12 kJ of work on the surrounding. What is the increase in internal energy of the system?

(A) 18 kJ (B) 2.5 kJ
(C) 42 kJ (D) 360 kJ

60. Identify the process having $\Delta V = 0$

(A) Isochoric (B) Isobaric
(C) Isothermal (D) Adiabatic

61. What is the pH of solution having H^+ion concentration 3.981×10^{-7} M? $(\log 3.981 = 0.6000)$

(A) 5.6 (B) 4.6
(C) 7.6 (D) 6.4

62. Which among the following is NOT Lewis acid?

(A) $AlCl_3$ (B) H_2O
(C) BF_3 (D) Ag^+

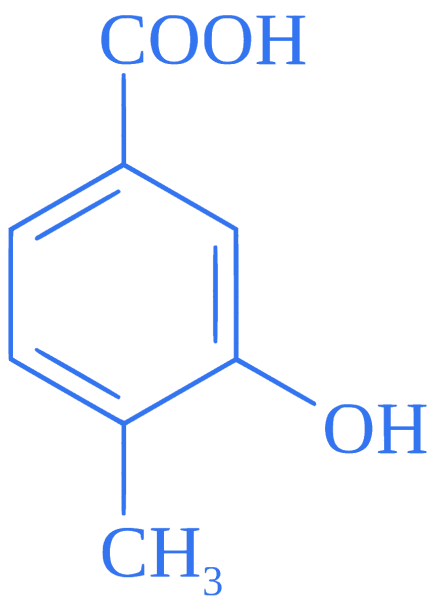
63. Which of the following correctly represents the process of reduction?

(A) Gain of oxygen (B) Increases in oxidation number
(C) Gain of electron and addition (D) Loss of electron

64. Which among the following elements is used in devising photo electric cells?

(A) K (B) Cs
(C) Ba (D) Be

65. What is the IUPAC name of following compound?



(A) 3-Hydroxy-4-methylbenzoic acid
(B) 5-methyl-3-Hydroxybenzoic acid
(C) 5-Hydroxy-4-methylbenzoic acid
(D) 4-methyl-3-Hydroxybenzoic acid

66. Identify the symmetrical ketone from the following compounds.

(A) Acetophenone
(B) Ethyl methyl ketone
(C) Ethylphenyl ketone
(D) Benzophenone

67. Which of the following statements in NOT correct?

(A) Homolytic cleavage of $C-C$ bond gives free radicals.
(B) Resonance structures are represented by drawing $\leftrightarrow$ arrown between them.
(C) Carbocation, carbanions and free radicals are reaction intermediates.
(D) Chlorine is said to exert + I effect in the carbon chain.

68. Which among the following compound does not exhibit cis-trans isomerism?

(A) $H_2C=C(R)_2$
(B) $R_1R_2C=CR_1R_2$
(C) $R-CH=CHR$
(D) $R_1CH=CR_1R_2$

69. Identify Finkelstein reaction from the following.

(A) $C_2H_5Cl + AgF \xrightarrow{\Delta} C_2H_5F + AgCl$
(B) $C_2H_5Cl + NaI \xrightarrow{\text{acetone}} C_2H_5I + NaCl$
(C) $C_2H_5Cl + NaOH \rightarrow C_2H_5OH + NaCl$
(D) $C_2H_5Cl + (KCN) \xrightarrow{\Delta}_{(alc)} C_2H_5OH + KCl$

70. Which among the following statements is NOT true according to principles of green chemistry?

(A) Use of catalyst minimize waste.
(B) Benzene being volatile compound pollutes air.
(C) Carrying out reactions at high temperature and high pressure minimizes use of energy.
(D) Use renewable chemicals rather than crude oil.

71. Which of the following statements is NOT true about Schottky defect?

(A) The electrical neutrality of the compound is not preserved.
(B) It occurs in ionic compound with sizes of cation and anion almost equal.
(C) The ions of ionic compound must have high co-ordination number.
(D) The density of substance decrease.

72. What is the co-ordination number of a particle in fcc crystal lattice?

(A) 4
(B) 8
(C) 12
(D) 6

73. Calculate the mass of bcc unit cell if metal has molar mass 56 g mol^{-1}.

(A) 1.86×10^{-22} gram
(B) 9.3×10^{-24} gram
(C) 2.79×10^{-24} gram
(D) 3.72×10^{-22} gram

74. Calculate the solubility of gas in water at 260 mmHg and 25°C if Henry's law constant of gas is 0.159 $moldm^{-3}$ atm^{-1} at 25°C

(A) 3.8×10^{-2} moldm $-$ 3
(B) 5.4×10^{-2} $moldm^{-3}$
(C) 2.7×10^{-2} $moldm^{-3}$
(D) 1.2×10^{-2} $moldm^{-3}$

75. What is the percentage dissociation of 0.1M acetic acid? $(\text{Ka} = 10^{-5})$

(A) 1%
(B) 10%
(C) 0.1%
(D) 0.01%

76. What is the molality of solution that has freezing point depression 3K and freezing point depression constant 5 K kg mol^{-1} ?

(A) 0.6 m
(B) 0.85 m
(C) 0.7 m
(D) 0.5 m

77. Which of the following is NOT a function of salt bridge?

(A) Provide electrical contact
(B) Convert electrical energy to chemical energy
(C) Maintain electrical neutrality
(D) Prevent mixing of solutions

78. What current strength is required to deposit 36 g of Ag in 7 minute from $AgNO_3$ solution by electrolysis? (Atomic mass Ag = 108)

(A) 11.44 amp
(B) 5.72 amp
(C) 76.6 amp
(D) 38.3 amp

79. Calculate standard potential of a cell having electrode reaction as
$Cd^{2+}_{(aq)} + 2e^- \rightarrow Cd_s E^\circ = -0.403$ V
$Zn^{2+}_{(aq)} + 2e^- \rightarrow Zn_{(s)} E^\circ = -0.763$ V

(A) 0.201 V
(B) 0.360 V
(C) 0.481 V
(D) 1.166 V

80. The instantaneous rate for reaction $2\,A + B \rightarrow C + 3D$, is given by

(A) $\frac{1}{3}\frac{d[D]}{dt}$
(B) $\frac{1}{2}\frac{d[A]}{dt}$
(C) $\frac{d[A]}{dt}$
(D) $\frac{d[B]}{dt}$

81. The rate constant of a reaction is 0.693×10^{-2} per minute. What is half-life period?

(A) 6000 second
(B) 6930 second
(C) 1000 second
(D) 4000 second

82. For the reaction, $2NO_{2(g)} \rightarrow 2NO_{(g)} + O_{2(g)}$, $\frac{d[NO_2]}{dt}$ is 1.3×10^{-5} mol L^{-1} sec^{-1}, What is rate of O_2 ?

(A) 1.3×10^{-6} mol $L^{-1} sec^{-1}$
(B) 3.25×10^{-6} mol L^{-1} sec^{-1}
(C) 1.62×10^{-6} mol L^{-1} sec^{-1}
(D) 6.5×10^{-6} mol L^{-1} sec^{-1}

83. Which is NOT an example of macro molecular colloid?

(A) Polythene
(B) Soap
(C) Nylon
(D) Proteins

84. Which from following activities results in to the formation of oleum in manufacture of sulphuric acid contact process?

(A) By adding sodium sulphite and SO_2 in water
(B) By passing SO_2 gas in to the dil. H_2SO_4
(C) Passing SO_2 gas through NaOH solution
(D) By absorbing SO_3 gas in conc. H_2SO_4

85. Which element from following has half-filled f orbital in +3 oxidation state

(A) U(Z = 92)
(B) Lr(Z = 103)
(C) Cm(Z = 96)
(D) Th(Z = 90)

86. Identify non-radioactive elements from following.

(A) Nd
(B) Np
(C) U
(D) Cf

87. Identify cationic complex from following.

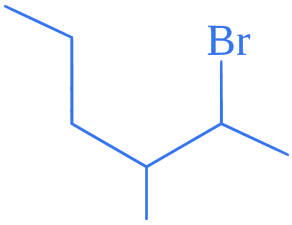
(A) Trioxalatocobaltate (III) ion
(B) Triamminetrinitrocobalt (III)
(C) Pentaamminechlorocobalt (II) sulphate
(D) Tetracyanonickelate (II) sulphate

88. Which among the following complexes does NOT exhibit different geometrical isomers? [M = metal ion and A, B, C = ligands]

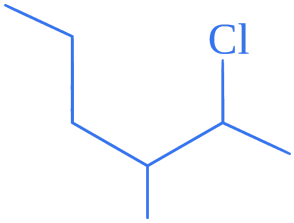
(A) $[MA_4BC]$
(B) $[MA_4\,B_2]$
(C) $[MA_6]$
(D) $[M(AA)_2\,B_2]$

89. Identify the alkyl halide that undergoes SN^2 reaction most fastly.

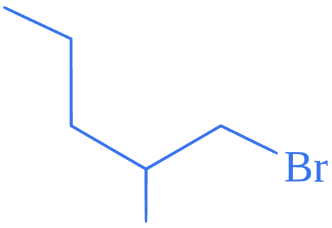
(A)



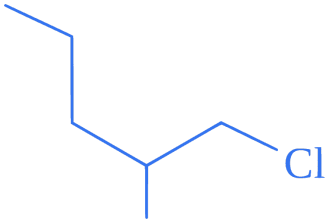
(B)



(C)



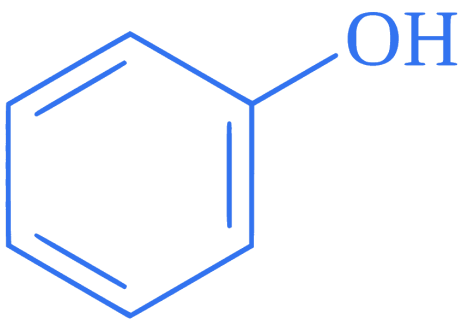
(D)



90. Which of the following compound is used as antifreeze agent in automobile radiators?

(A) CH_3OH

(B)



(C) $HO - CH_2 - CH_2 - OH$

(D) C_2H_5OH

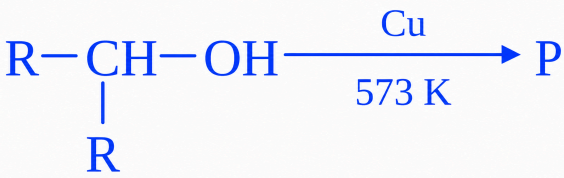
91. Cumene on air oxidation in presence of co-naphthenate forms

(A) Cumene hydroperoxide
(B) Acetone
(C) Phenol
(D) Phenol + acetone

92. Which among the following compounds does not exhibit iodoform test?

(A) Acetaldehyde
(B) sec-Butyl alcohol
(C) n-Butyl alcohol
(D) Acetophenone

93. Identify the product P in following reaction



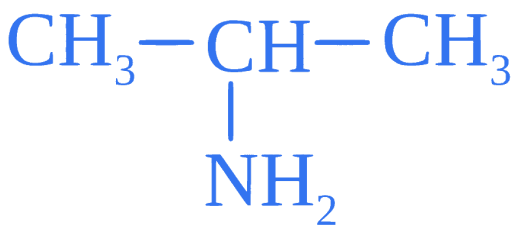
(A) R-CHO
(B) R-CO-R'
(C) R – COOH
(D) $R - CH_3$

collegedunia

94. Identify the amine that does not form alcohol by the action of $NaNO_2$ and HCl.

(A) $(CH_3)_3 - C - NH_2$

(B) $CH_3 - CH_2 - NH_2$



(C)

(D) $(CH_3)_2 - NH$

95. Identify Hinsberg reagent from following.

(A) Benzene sulphonly chloride

(B) Beynzyl chloride

(C) Benzoyl chloride

(D) Benzene diazonium chloride

96. Identify product P in the following reaction. $C_2H_5 - Mg - Br + NH_3 \rightarrow P$

(A) C_2H_5Br

(B) $HC \equiv CH$

(C) C_2H_6

(D) $H_2C = CH_2$

97. Which nitrogen atom of purine base is bonded with furanose forming nucleoside?

(A) 2

(B) 7

(C) 9

(D) 1

98. Which from following amino acids is NOT synthesize in our body?

(A) Cysteine

(B) Asparagine

(C) Phenylalanine

(D) Serine

99. Identify the polymer obtained by using



(A) PVC

(B) Buna-S

(C) Polyacrylamide

(D) Glyptal

100. Which among the following polymers is used to obtain surgical sutures?

(A) Nylon 6

(B) Polyacrylonitrile

(C) Nylon 6, 6

(D) Buna-N

101. The domain of the definition of the function $f(x) = \frac{1}{4-x^2} + \log_{10}\left(x^3 - x\right)$ is

(A) $(-1,0) \cup (1,2) \cup (3,\infty)$

(B) $(-1,0) \cup (1,2) \cup (2,\infty)$

(C) $(-2,-1) \cup (-1,0) \cup (2,\infty)$

(D) $(1,2) \cup (2,\infty)$

102. In a triangle ABC with usual notations, If $a : b : c = 7 : 8 : 9$: then $\cos A : \cos B : \cos C =$

(A) 14:11:6 (B) 7:8:9

(C) 3:4:5 (D) 5:6:7

103. If $\tan A = \frac{1}{2}$, $\tan B = \frac{1}{3}$ then $\tan(A + 2B)$ has the value

(A) 2 (B) 3

(C) 4 (D) 1

104. The principal solutions of the equation $\sqrt{3}\,\text{cosec}\, X + 2 = 0$ are

(A) $\frac{2\pi}{3}, \frac{5\pi}{3}$ (B) $\frac{4\pi}{3}, \frac{5\pi}{3}$

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

105. The set of all possible values of θ in the interval $(0, \pi)$ for which the points $(1, 2)$ and $(\sin\theta, \cos\theta)$ lie on the same side of the line $x + y = 1$, is _____.

(A) $\left(0, \frac{\pi}{2}\right)$ (B) $\left(0, \frac{\pi}{4}\right)$

(C) $\left(0, \frac{3\pi}{4}\right)$ (D) $\left(\frac{\pi}{4}, \frac{3\pi}{4}\right)$

106. A value of θ, for which $\frac{2+3i\sin\theta}{1-2\sin\theta}$, $\mathrm{i} = \sqrt{-1}$ is purely imaginary, is

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

(C) $\sin^{-1}\left(\frac{1}{\sqrt{3}}\right)$ (D) $\sin^{-1}(\sqrt{3})$

107. A man P has 7 friends, 4 of them are ladies and 3 are men, His wife Q also has 7 friends, 3 of them are ladies and 4 are men. Assume P and Q have no common friends. Then the total number of ways in which P and Q together can throw a party inviting 3 ladies and 3 men, so that 3 friends of each of P and Q are in this party, is _____

(A) 468 (B) 485

(C) 484 (D) 469

108. Let a and b be two non-zero real numbers. The equation $\left(ax^2 + by^2 + c\right)\left(x^2 - 5xy + 6y^2\right) = 0$ represents

(A) Four straight lines, when $c = 0$ and a, b are of the same sign.

(B) A circle and an ellipse, when a and b are of the same sign and c is of sign opposite to that of a

(C) Two straight lines and a hyperbola, when a and b are of the same sign and c is of sign opposite to that of a

(D) Two straight lines and a circle, when $a = b$ and c is of sign opposite to that of a

109. Given two circles $x^2 + y^2 + 8x - 6y - 24 = 0$ and $x^2 + y^2 - 4x + 10y + 20 = 0$. Then they are

(A) Disjoint. (B) Concentric,

(C) Touching internally (D) Touching externally.

110. $\lim_{x\to\infty}\left[\frac{8x^2+5x+3}{2x^2-7x-5}\right]^{\frac{4x+3}{8x-1}} =$

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

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

111. The inverse of statement pattern $(p \vee q) \to (p \wedge q)$ is

(A) $(\sim p \vee \sim q) \to (\sim p \wedge \sim q)$

(B) $(\sim p \wedge \sim q) \to (\sim p \vee \sim q)$

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

(D) $\sim (p \vee q) \to (p \wedge q)$

112. The statement pattern $[p \to (q \to p)] \to [p \to (p \vee q)]$ is

(A) A tautology (B) A contradiction

(C) A contingency (D) Equivalent to $p \leftrightarrow q$

113. For statement; If a quadrilateral $ABCD$ is a rhombus then its opposite sides are parallel", its contrapositive and converse are respectively given by

(A) i. If opposite sides of a quadrilateral $ABCD$ are not parallel, then quadrilateral $ABCD$ is a rhombus. ii. If opposite sides of a quadrilateral $ABCD$ are not parallel, then the quadrilateral $ABCD$ is a rhombus.

(B) i. If opposite sides of a quadrilateral $ABCD$ are not parallel then quadrilateral $ABCD$ is not rhombus. ii. If opposite sides of a quadrilateral $ABCD$ are parallel, then quadrilateral $ABCD$ is not rhombus.

(C) i. If opposite sides of a quadrilateral $ABCD$ are parallel, then quadrilateral $ABCD$ is not a rhombus. ii. If opposite sides of a quadrilateral $ABCD$ are parallel, then quadrilateral $ABCD$ is a rhombus.

(D) i. If opposite sides of a quadrilateral $ABCD$ are parallel, then quadrilateral $ABCD$ is not a rhombus. ii. If opposite sides of a quadrilateral $ABCD$ are not parallel, then quadrilateral $ABCD$ is a rhombus.

114. In an experiment with 15 observations on x , we have $\sum x^2 = 2830, \sum x = 170$. One observation that was 20 was found to be wrong and was replaced by the correct value 30 , then the corrected variance is

(A) 177.33 (B) 188.66

(C) 80.33 (D) 78

115. The value of $\cos\left(\tan^{-1}\left(\sin\left(\cot^{-1} x\right)\right)\right)$ is

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

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

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

(A) $\frac{x+y}{1-xy}$ (B) $\frac{x-y}{1+xy}$

(C) $\frac{x-y}{1-xy}$ (D) $\frac{x+y}{1+xy}$

117. If $(BA)^{-1} = C$ where $B = \begin{bmatrix} 2 & 6 & 4 \\ 1 & 0 & 1 \\ -1 & 1 & -1 \end{bmatrix}$ and $C = \begin{bmatrix} -1 & 0 & 1 \\ 1 & 1 & 3 \\ 2 & 0 & 2 \end{bmatrix}$, then A^{-1} is given by

(A) $\begin{bmatrix} -3 & -3 & 5 \\ 0 & 9 & 2 \\ 2 & 14 & 6 \end{bmatrix}$ (B) $\begin{bmatrix} -3 & -5 & -5 \\ 0 & 9 & 2 \\ 2 & 14 & 6 \end{bmatrix}$

(C) $\begin{bmatrix} -3 & -5 & 5 \\ 0 & 9 & 14 \\ 2 & 2 & 6 \end{bmatrix}$ (D) $\begin{bmatrix} -3 & 5 & 5 \\ 0 & 9 & 2 \\ 2 & 14 & 6 \end{bmatrix}$

118. If A is non-singular matrix of order 3 such that $(A - 2I)(A - 4I) = 0$, then $\frac{1}{6}A + \frac{4}{3}A^{-1}$ is (where I is a unit matrix of order 3 and 0 is a null matrix of order 3)

(A) 6I (B) I

(C) 0 (D) 2I

119. If the function $f(x)$ is continuous on its domain $[-2, 2]$ where

$f(x) = \frac{\sin ax}{x} + 3, -2 \le x < 0 = x + 5, 0 \le x \le 1$

$= \sqrt{x^2+8} - b, 1 < x \le 2$

, then $7a + b + 1$ is equal to

(A) 10 (B) 11

(C) 14 (D) 12

120. If $x^y \cdot y^x = 16$, then $\frac{dy}{dx}$ at $(2, 2)$ is

(A) -2 (B) 2

(C) 1 (D) -1

121. If $y = \cos^2\left(\frac{5x}{2}\right) - \sin^2\left(\frac{5x}{2}\right)$, then $\frac{d^2y}{dx^2} =$

(A) -25y (B) $\frac{25}{2}y$

(C) $-\frac{25}{2}y$ (D) 25y

122. For $x > 1$, if $(2x)^{2y} = 4e^{2x-2y}$, then $(1 + \log_e 2x)^2 \frac{dy}{dx}$ is equal to

(A) $x \log_e 2x$ (B) $\log_e 2x$

(C) $\frac{x \log_e 2x + \log_e 2}{x}$ (D) $\frac{x \log_e 2x - \log_e 2}{x}$

123. The derivative of $\tan^{-1}\left(\frac{\sqrt{1+x}-\sqrt{1-x}}{\sqrt{1+x}+\sqrt{1-x}}\right)$ is

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

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

124. If $y = e^{4x} + 2e^{-x}$ satisfies the equation $\frac{d^2y}{dx^2} + A\frac{dy}{dx} + By = o$ then values of and B are respectively

(A) 3,4 (B) -3,-4

(C) 4,3 (D) -4,-3

125. The radius of right circular cylinder increase at the rate 0.1 cm/ min and height decreases at the rate of $0 \cdot 2$ cm/ min The rate of change of volume of the cylinder in cm^3/ min, when the radius is 2 cm and height is 3 cm, is

(A) $-2pm^3$/ min (B) $\frac{-3\pi}{5}$ cm^3/ min

(C) $\frac{-8\pi}{5}$ cm^3/ min (D) $\frac{2\pi}{5}$ cm^3/ min

126. If the curves $y^2 = 6x, 9x^2 + by^2 = 16$ intersect each other at right angles, the value of b is

(A) 4 (B) $\frac{7}{2}$

(C) 6 (D) $\frac{9}{2}$

127. The rate of change volume of a sphere with respect to its surface area when the radius is 5 meters is

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

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

128. $\int \frac{(\log x - 1)^2}{[1+(\log x)^2]^2} dx =$ (where C is constant of integration.)

(A) $\frac{\log x}{(1+\log x)^2} + C$ (B) $\frac{e^{\log x}}{1+\log x} + C$

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

129. $\int \frac{e^{\frac{x}{2}}}{\sqrt{e^{-x} - e^x}} dx = \sin^{-1}(f(x)) + C$, (where C is constant of integration.) then $f(2)$ has the value

(A) e (B) e^2

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

130. $\int \frac{\log\left(x+\sqrt{1+x^2}\right)}{\sqrt{1+x^2}} dx = \frac{1}{2}(g(x))^2 + C$, (where C is constant of integration.) Then $g(x) =$

(A) $\log\left(x + \sqrt{1+x^2}\right)$ (B) $\log\left(x + \sqrt{1+2x^2}\right)$

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

131. If the straight-line $x = b$ divides the area enclosed by $y = (1-x)^2$ $y = 0$ and $x = 0$ in two parts $R_1(0 \le x \le b)$ and $R_2(b \le x \le 1)$ such that $R_1 - R_2 = \frac{1}{4}$. Then b equals

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

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

132. $\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} \frac{e^x(x \sin x)}{e^{2x}-1} dx =$

(A) 0 (B) $\frac{\pi}{3}$

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

133. The value of $\int \cos(\log_e(x))dx$ is equal to (where C is a constant of integration.)

(A) $x[\cos(\log x) - \sin(\log x)] + C$

(B) $\frac{x}{2}[\sin(\log x) - \cos(\log x)] + C$

(C) $\frac{x}{2}[\sin(\log x) + \cos(\log x)] + C$

(D) $x[\cos(\log x) + \sin(\log x)] + C$

134. $\frac{\pi}{2}$ The value of $\int_0 \frac{dx}{1+\tan^3 x}$

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

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

135. If a body is heated to 110°C and placed in air at 10°C after 1 hour its temperature is 60°C, then the additional time required for it to cool to 30°C is

(A) $\frac{\log 5}{\log 2}$hrs (B) $\frac{\log 2}{\log 5}$hrs

(C) $\left(\frac{\log 5}{\log 2} - 1\right)$ hrs (D) $\left(\frac{\log 5}{\log 2} + 1\right)$ hrs

136. If $\left(x^2 + y^2\right) dy = xy\, dx$, with $y(x_0) = e, y(1) = 1$, then x_0 has the value

(A) $\sqrt{3}e$ (B) $\sqrt{2}e$

(C) e (D) $\sqrt{3}e^2$

137. The sum of the distinct real values of μ, for which the vector $\mu\hat{i} + \hat{j} + \hat{k}, \hat{i} + \mu\hat{j} + \hat{k}, \hat{i} + \hat{j} + \mu\hat{k}$ are coplanar is

(A) 1 (B) -1

(C) 2 (D) 0

138. If $|\bar{a}| = 5, |\bar{b}| = 13$ and $|\bar{a} \times \bar{b}| = 25$. If $\frac{\pi}{2} < \theta < \pi$ where θ is angle between $\bar{a}, \bar{b}$ then $\bar{a} \cdot \bar{b}$ has the value

(A) -60 (B) -30

(C) 60 (D) 30

139. The vector projection of $\overline{PQ}$ on $\overline{AB}$, where $P \equiv (-2, 1, 3), Q \equiv (3, 2, 5), A \equiv (4, -3, 5)$ and $B \equiv (7, -5, -1)$ is

(A) $\frac{1}{49}(3\hat{i} - 2\hat{j} - 6\hat{k})$ (B) $\frac{1}{7}(3\hat{i} - 2\hat{j} + 6\hat{k})$

(C) $(3\hat{i} - 2\hat{j} - 6\hat{k})$ (D) $\frac{1}{7}(3\hat{i} - 2\hat{j} - 6\hat{k})$

140. If the vectors $2\hat{i}-3\hat{j}+6\hat{k}$ and $\bar{b}$ are collinear and $|\bar{b}|=14$, then $\bar{b}$ has the value

(A) $4\hat{i}+6\hat{j}+12\hat{k}$ (B) $-4\hat{i}-6\hat{j}-12\hat{k}$

(C) $4\hat{i}-6\hat{j}+12\hat{k}$ (D) $12\hat{i}+5\hat{j}+\sqrt{17}\hat{k}$

141. $\int_0^1 \frac{8\log(1+x)}{1+x^2}\,dx =$

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

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

142. The shortest distance between the lines $\frac{x-3}{3}=\frac{y-8}{-1}=\frac{z-3}{1}$ and $\frac{x+3}{-3}=\frac{y+7}{2}=\frac{z-6}{4}$ is

(A) $2\sqrt{30}$ units (B) $\sqrt{30}$ units

(C) $4\sqrt{30}$ units (D) $3\sqrt{30}$ units

143. The value of k such that $\frac{x-4}{1}=\frac{y-2}{1}=\frac{z-k}{2}$ lies in the plane $2x-4y+z=7$, is

(A) No real value (B) 4

(C) 7 (D) -7

144. The direction cosines of the line, which is perpendicular to the lines with direction rations $-1,2,2$ and $0,2,1$, are respectively

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

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

145. The line drawn $(4,-1,2)$ and $(-3,2,3)$ meets the plane at right angles at the point $(-10,5,4)$ then the equation of plane is

(A) $2x-y-z+29=0$

(B) $7x-3y-z+89=0$

(C) $x-y+z+11=0$

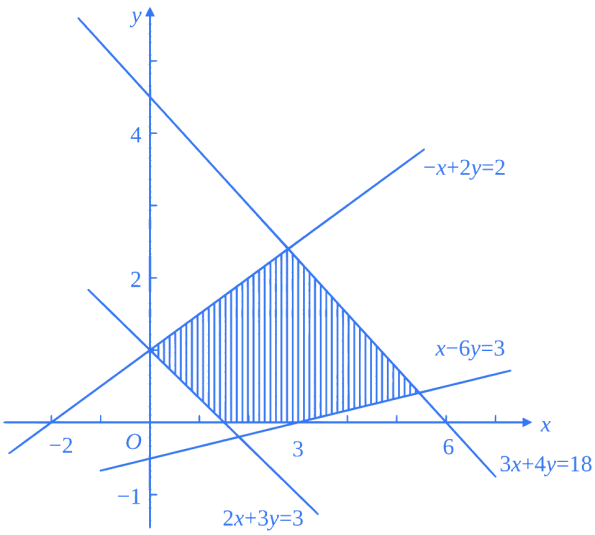
(D) $x+y+z+1=0$

146. The equation of a line passing through the point $(2,1,3)$ and perpendicular to the lines $\frac{x-1}{1}=\frac{y-2}{2}=\frac{z-3}{3}$ and $\frac{x}{-3}=\frac{y}{2}=\frac{z}{5}$ is

(A) $\frac{x-2}{-2}=\frac{y-1}{7}=\frac{z-3}{4}$ (B) $\frac{x-2}{2}=\frac{1-y}{7}=\frac{z-3}{4}$

(C) $\frac{x-2}{2}=\frac{y-1}{4}=\frac{z-3}{7}$ (D) $\frac{x-2}{2}=\frac{1-y}{4}=\frac{z-3}{7}$

147. The shaded area in the figure below is the solution set for a Certain Linear Programming problem. The linear constraints are given by



(A) $3x+4y\le 18, 2x+3y\ge 3, x-6y\ge 3,$
$-x+2y\le 2, x\ge 0, y\ge 0$

(B) $3x+4y\le 18, 2x+3y\ge 3, x-6y\le 3,$
$-x+2y\le 2, x\ge 0, y\ge 0$

(C) $3x+4y\le 18, 2x+3y\ge 3, x-6y\ge 3,$
$-x+2y\ge 2, x\ge 0, y\ge 0$

(D) $3x+4y\le 18, 2x+3y\le 3, x-6y\ge 3,$
$-x+2y\le 2, x\ge 0, y\ge 0$

148. Let a random variable X have a Binomial distribution with mean 8 and variance 4 , If $P(X\le 2)=\frac{k}{2^{16}}$ then k is equal to

(A) 121 (B) 17

(C) 137 (D) 1

149. A, B, C are three events, one of which must and only one can happen the odds in favour of A are $4:6$, odds against B are $7:3$, then odds against C are

(A) 7:3 (B) 3:7

(C) 6:4 (D) 4:6

150. If the p.m.f. of a discrete random variable X is $P(X = x) = \frac{c}{x^3}$, $x = 1, 2, 3 = 0$, otherwise then $E(X)$ is equal to

(A) $\frac{297}{294}$ (B) $\frac{249}{225}$

(C) $\frac{343}{297}$ (D) $\frac{294}{251}$

- End of Question Paper -