MHT CET 2026 PCM Question Paper April 16 Shift 2

General Instructions

(i) This question paper contains 150 questions. All questions are compulsory.

(ii) It comprises 150 single-correct multiple-choice questions.

(iii) Attempt every question; detailed solutions are provided in the companion solutions booklet.

Physics

Questions 1 to 50 | 1 mark each | 50 marks

1. The error in the measurement of length and mass of a cube is 3% and 4% respectively. The error in the measurement of its density will be

(A) 13%

(B) 6%

(C) 9%

(D) 15%

2. Vectors $a\hat{i} + b\hat{j} + \hat{k}$ and $2\hat{i} - 3\hat{j} + 4\hat{k}$ are perpendicular to each other when $3a + 2b = 7$, the ratio of a to b is $x/2$. The value of x is

(A) 4

(B) 1

(C) 8

(D) 3

3. Two objects are projected with same velocity 'u' at different angles α and β with the horizontal. If $\alpha + \beta = 90°$, the ratio of horizontal range of the first object to the second object will be $[sin(\pi - \theta) = sin\theta]$

(A) 4 : 1

(B) 2 : 1

(C) 1 : 1

(D) 1 : 2

4. A body of mass 1kg begins to move under the action of a time dependent force $\vec{F} = (t\hat{i} + 3t^2\hat{j})$N where $\hat{i}$ and $\hat{j}$ are the unit vectors along x and y axis. The power developed by the above force at time $t = 2$s will be (in watt)

(A) 100

(B) 50

(C) 25

(D) 5

5. A solid sphere of mass M and a disc of mass $\frac{M}{2}$ have the same radius. The ratio of moment of inertia of the disc about a tangent in its plane to the moment of inertia of the sphere about its tangent will be

(A) 15 : 8

(B) 25 : 56

(C) 12 : 7

(D) 16 : 9

6. A uniform solid cylinder with radius R and length L has moment of inertia I_1 about the axis of the cylinder. A concentric solid cylinder of radius $R/2$ and length $L/2$ is carved out of the original cylinder. If I_2 is the moment of inertia of the carved out portion of the cylinder then I_1/I_2 is (Both I_1 and I_2 are about the axis of the cylinder)

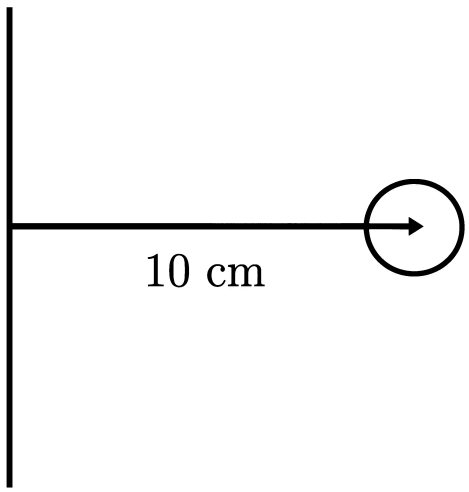
(A) 4 : 1

(B) 8 : 1

(C) 16 : 1

(D) 32 : 1

7. Solid sphere is rotating about an axis as shown in figure. If the radius of the sphere is 5 cm, then radius of gyration about that axis will be $\sqrt{x}$ cm. The value of x is



(A) 100

(B) 110

(C) 120

(D) 140

8. A body of mass m is taken from earth surface to a height h equal to twice the radius of earth, the increase in potential energy will be (g = acceleration due to gravity on earth's surface) (R - radius of earth)

(A) $\frac{2}{3}$mgR

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

(C) $\frac{1}{2}$mgR

(D) 3mgR

9. One thousand small water drops of equal radii combine to form a big drop. The ratio of final surface energy to the total initial surface energy is

(A) 1 : 1

(B) 1 : 10

(C) 1 : 100

(D) 1 : 1000

10. Under isothermal condition, two soap bubbles of radii r_1 and r_2 combine to form a single soap bubble of radius R. The surface tension of the soap solution is (P = outside pressure)

(A) $\frac{P(R^3-r_1^3-r_2^3)}{4(r_1^2+r_2^2-R^2)}$

(B) $\frac{P(R^3+r_1^3+r_2^3)}{2(r_1^2-r_2^2+R^2)}$

(C) $\frac{P(r_1^3-r_2^3-R^3)}{(R^2+r^2+r^2)}$

(D) $\frac{P(R^3-r_1^3+r_2^3)}{2(r_1^2+r_2^2-R^2)}$

11. A horizontal pipe carries water in a streamline flow. At point along the pipe, where the cross-sectional area is A_1, the velocity of water is V_1 and the pressure is P_1. What is the pressure of water at another point where the cross-sectional area is A_2?

(A) $P_1 - \frac{\rho V_2^2}{2A_1^2}(A_2^2 - A_1^2)$

(B) $P_1 + \frac{\rho V_1^2}{2A_2^2}(A_2^2 - A_1^2)$

(C) $P_1 \rho V_1^2 (A_1^2 - A_2^2)$

(D) $P/\rho V_1^2 A_2^2$

12. A bowl filled with very hot water cools from 98°C to 86°C in 2 minutes when the room temperature is 22°C. How long it will take to cool from 75°C to 69°C ?

(A) 0.5 minute

(B) 1.4 minute

(C) 1 minute

(D) 2 minute

13. A Carnot engine with efficiency 50% takes heat from a source at 600 K. To increase the efficiency by 20%, keeping temperature of the sink same, the new temperature of the source will be

(A) 300K

(B) 900K

(C) 1000K

(D) 360K

14. One gram of a liquid is converted to vapour at 3×10^5 Pa pressure. If 10% of the heat supplied is used for increasing the volume by $1600cm^3$ during this phase change, then the increase in internal energy in the process will be

(A) $4.32 \times 10^8 J$

(B) $4800J$

(C) $4320J$

(D) $4.32 \times 10^5 J$

15. The average transnational kinetic energy of a molecule in a gas is E_1. The kinetic energy of the electron (e) accelerated from rest through potential difference 'V' volt is E_2. The temperature at which $E_1 = E_2$ possible is (mass of molecule and electron is same) (N = number of molecules, V = Velocity, R = gas constant)

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

(B) $\frac{VNe}{2R}$

(C) $\frac{3NeV}{2R}$

(D) $\frac{5NeV}{3R}$

16. A rigid diatomic gas having molar mass m is contained in an insulated container. The container is moving with velocity V. If it is stopped suddenly, the change in temperature is (R - gas constant)

(A) $\frac{mV^2}{R}$

(B) $\frac{mV^2}{3R}$

(C) $\frac{mV^2}{5R}$

(D) $\frac{mV^2}{7R}$

17. If a gas is compressed isothermally then the r.m.s. velocity of the molecules

(A) increases

(B) remains the same

(C) decreases

(D) first increases and then decreases

18. A mass m_1 performs S.H.M. with amplitude A which is connected to horizontal spring. While mass m_1 passing through mean position, another mass m_2 ($m_2 < m_1$) is placed on it so that both masses move together with amplitude A_1. The ratio of A/A_1 is

(A) $[\frac{m_1+m_2}{m_1}]^{\frac{1}{2}}$

(B) $[\frac{m_1}{m_1+m_2}]^{\frac{1}{2}}$

(C) $\frac{m_1}{m_1+m_2}$

(D) $\frac{m_2}{m_1+m_2}$

19. The maximum potential energy of a block executing S.H.M. is E and amplitude of oscillation is 'A'. The kinetic energy of the block at amplitude A/2 is

(A) $\frac{3E}{4}$

(B) E

(C) $\frac{2E}{4}$

(D) $\frac{5E}{4}$

20. The time taken by simple pendulum for one oscillation is T on earth's surface. Its time period becomes xT when taken to a height R (equal to earth's radius) above the earth's surface. The value of x is

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

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

(C) 2

(D) 4

21. An air column in a pipe which is closed at one end will be in resonance with a vibrating tuning fork of frequency 415 Hz for various vibrating air columns. Which one of the following lengths is not in resonance ? (velocity of sound in air = 332 m/s) (Neglect end correction)

(A) 20cm

(B) 40cm

(C) 60cm

(D) 100cm

22. Two waves $Y_1 = 0.25sin316t$ and $Y_2 = 0.25sin310t$ are propagating along the same direction. The number of beats produced per second are

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

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

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

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

23. When open pipe is closed from one end then third overtone of closed pipe is higher in frequency by 150Hz than second overtone of open pipe. The fundamental frequency of open end pipe will be (Neglect end correction)

(A) 75Hz

(B) 150Hz

(C) 225Hz

(D) 300Hz

24. A person observes two moving trains. 'A' reaching the station and 'B' leaving the station with equal speed of 30m/s. If both trains emit sounds with frequency 300 Hz, (speed of sound = 330 m/s) difference of frequencies heard by the person will be

(A) 10Hz

(B) 33Hz

(C) 55Hz

(D) 80Hz

25. Two spherical hollow spheres of radii 'R_1' and 'R_2' are charged with same charge. Let 'σ_1' and 'σ_2' are their respective charge densities, then the ratio σ_1 to σ_2 is

(A) $R_1 : R_2$

(B) $R_2 : R_1$

(C) $R_2^2 : R_1^2$

(D) $R_1^2 : R_2^2$

26. An electric dipole of length $0.5\mu m$ is placed with its axis making an angle of $30°$ with uniform electric field $10^4 V/m$. If it experiences a torque of $5 \times 10^{-9} Nm$, the magnitude of the charge on the dipole is ($sin30° = 0.5$)

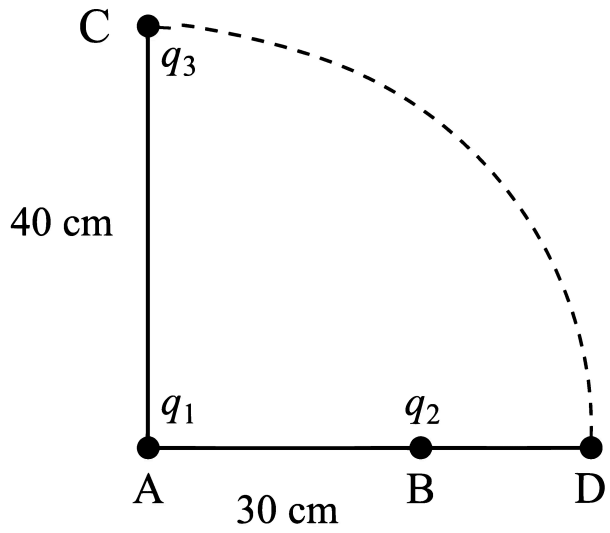
(A) $1\mu C$

(B) $1.5\mu C$

(C) $2\mu C$

(D) $2.5\mu C$

27. Two charges q_1 and q_2 are separated by a distance of 30cm. A third charge q_3 initially at point C is shown in figure, is moved along the circular path of radius 40 cm from C to D. If the difference in potential energy due to movement of q_3 from C to D is $q_3 k/4\pi\varepsilon_0$, the value of K is (ε_0 = permittivity of free space)



(A) $8q_2$

(B) $8q_1$

(C) $6q_2$

(D) $6q_1$

28. A capacitor has capacity C when it's parallel plates are separated by air medium of thickness 'd'. A slab of material of dielectric constant K having area equal to that of plates but thickness $\frac{d}{2}$ is inserted between the plates. Capacitance of the capacitor in the presence of slab will be

(A) KC

(B) 2KC

(C) $\frac{KC}{K+1}$

(D) $\frac{2KC}{K+1}$

29. A galvanometer has resistance G and range Vg. How much resistance is required to read voltage up to V volt?

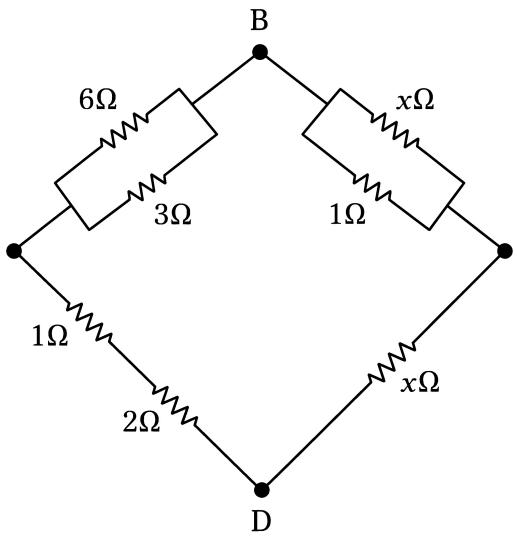
(A) GV_g

(B) $G(\frac{V-V_g}{V})$

(C) $G(\frac{V}{V_g}-1)$

(D) $G(\frac{V+V_g}{V})$

30. If the potential difference between points B and D is zero in the given circuit, the value of x is $\frac{1}{n}\Omega$. The value n is



(A) 2

(B) 1

(C) 3

(D) 4

31. The magnetic field intensity (H) at the centre of a long solenoid having 'n' turns per unit length and carrying a current I, when no material is kept in it is (μ_0 = permeability of free space)

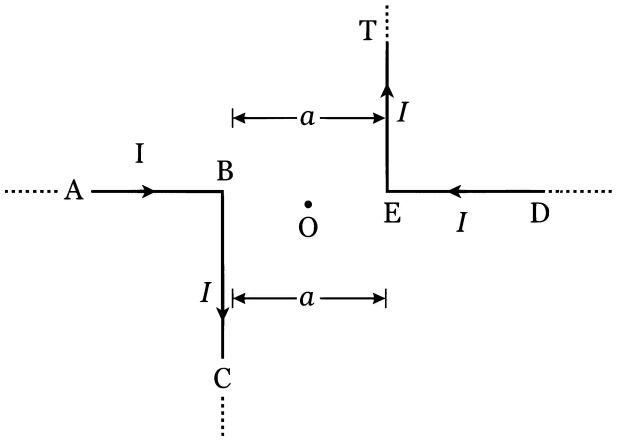
(A) n/I

(B) nI

(C) $\mu_0 I$

(D) μ_0/nI

32. The magnitude of magnetic induction at mid point 'O' due to current arrangement as shown in figure will be (μ_0 = permeability of free space)



(A) $\frac{\mu_0 I}{2\pi a}$

(B) zero

(C) $\frac{\mu_0 I}{4\pi a}$

(D) $\frac{\mu_0 I}{\pi a}$

33. A circular loop of radius R is carrying current I. The ratio of magnetic field at the center of circular loop and at a distance R from the center of the loop on its axis is

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

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

(C) $\sqrt{8} : 1$

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

34. A circular coil of radius 'r' is placed on another circular coil whose radius is 'R' and the current flowing through it is changing and their centers coincide. ($R \gg r$). If both the coils are coplanar, then the mutual inductance between them is proportional to

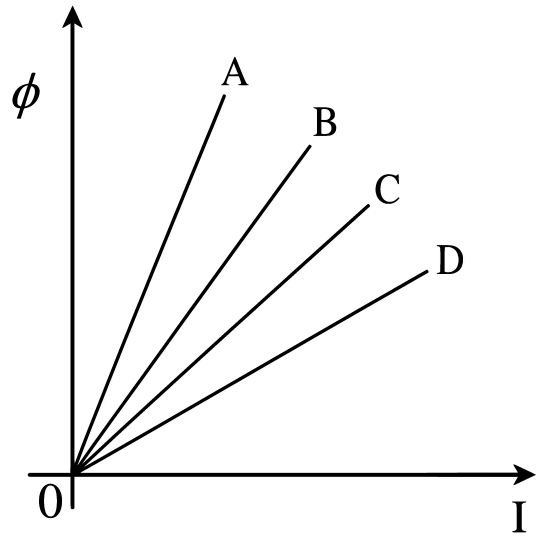
(A) $\frac{r}{R}$

(B) $\frac{R}{r}$

(C) $\frac{R^2}{r}$

(D) $\frac{r^2}{R}$

35. A graph of magnetic flux (Φ) versus current (I) is shown for four inductors A, B, C, D. The smallest value of self inductance is for inductor.



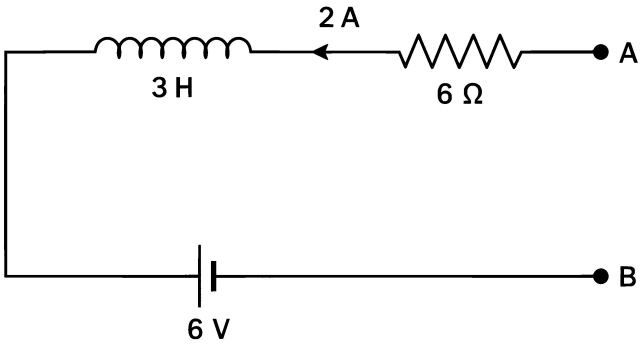
(A) A

(B) B

(C) C

(D) D

36. In the given circuit, if $dI/dt = -1\text{A/s}$ then the value of V_{AB} at this instant will be



(A) 30V

(B) 20V

(C) 10V

(D) 15V

37. Alternating current of peak value $(\frac{2}{\pi})$ A flows through the primary coil of a transformer. The coefficient of mutual inductance between primary and secondary coils is 1H. The peak value of induced e.m.f. in the secondary coil is
(Frequency of a.c. = 50 Hz)

(A) 100V

(B) 300V

(C) 200V

(D) 400V

38. Series LCR circuit containing an a.c. source of 100V has a inductor and a capacitor of reactance 24Ω and 16Ω respectively. If a resistance of 6Ω is connected in series, then the potential difference across the series combination of inductor and capacitor only is

(A) 80V

(B) 8V

(C) 40V

(D) 20V

39. An inductor of inductance $2\mu H$ is connected in series with a resistance, a variable capacitor and an a.c. source of 10 kHz. The value of capacitance for which maximum current is drawn in to the circuit is $\frac{1}{x}F$, where the value of x is (Take $\pi^2 = 10$)

(A) 8000

(B) 600

(C) 400

(D) 1600

40. A ray of light passes from the vacuum into a medium of refractive index 'n'. If the angle of incidence is twice the angle of refraction, then the angle of incidence in terms of refractive index is

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

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

(C) $2sin^{-1}(\frac{n}{2})$

(D) $cos^{-1}(\frac{n}{2})$

41. A convex lens having refractive index 1.6 has focal length 12 cm, when it is in air. The focal length of that lens when placed in water is (refractive index of water = 1.28)

(A) 655mm

(B) 288mm

(C) 555mm

(D) 355mm

42. Three identical polaroids P_1, P_2 and P_3 are placed one after another. The pass axis of P_2 and P_3 are inclined at angle of $60°$ and $90°$ with respect to axis of P_1. The source has an intensity I_0. The intensity of light finally coming out is

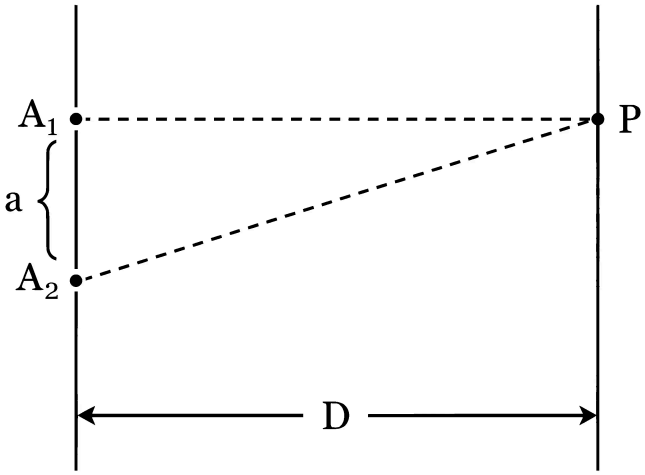
(A) $\frac{I_0}{2}cos^2 30° cos^2 90°$

(B) $\frac{I_0}{2}cos^2 60° cos^2 30°$

(C) $I_0 cos^2 60° cos^2 30°$

(D) zero

43. In Young's double slit experiment, two slits are illuminated with a light of wavelength λ. The line joining A_1P is perpendicular to A_1A_2 as shown in figure. If the first minimum is detected at P, the value of slits separation 'a' will be
(D = distance between source and screen)



(A) λD

(B) $\sqrt{\lambda D}$

(C) $\sqrt{\frac{\lambda}{D}}$

(D) $\sqrt{\frac{D}{\lambda}}$

44. When a light of wavelength 'λ' falls on the emitter of a photosensitive surface, maximum speed of emitted photoelectrons is 'V'. If the incident wavelength is changed to '$2\lambda/3$', maximum speed of emitted photoelectrons will be

(A) less than $V(1.5)^{\frac{1}{2}}$

(B) greater than $V(1.5)^{\frac{1}{2}}$

(C) less than V

(D) less than $\frac{V}{2}$

45. A photoemissive substance is illuminated with a radiation of wavelength λ_i so that it releases electrons with de-Broglie wavelength λ_e. The longest wavelength of radiation that can emit photoelectron is λ_0. Expression for de-Broglie wavelength is (m = mass of electron, h = Planck's constant, C = Speed of light)

(A) $(h\lambda_i/2mc)^{\frac{1}{2}}$

(B) $(h\lambda_0/2mc)^{\frac{1}{2}}$

(C) $[h/2mc(\frac{1}{\lambda_i} - \frac{1}{\lambda_0})]^{\frac{1}{2}}$

(D) $[h/[2mc(\frac{1}{\lambda_i} - \frac{1}{\lambda_0})]^{\frac{1}{2}}$

46. An electron makes a transition from an excited state to the ground state of a hydrogen like atom. Out of the following statements which one is correct ?

(A) K.E, P. E. and T.E. decreases

(B) K.E. increases but P. E. and T.E. decreases

(C) K.E. and T.E. decreases but P.E. increases

(D) K.E. decreases, P.E. increases but T.E. remains the same

(A) A

(B) B

(C) C

(D) D

47. The ratio of the density of oxygen nucleus ($_{8}^{16}O$) and helium nucleus ($_{2}^{4}He$) is

(A) 1 : 1

(B) 2 : 1

(C) 4 : 1

(D) 8 : 1

48. Electrical conductivity of insulators is

(A) exactly zero

(B) extremely large

(C) extremely small

(D) sometimes small and sometimes large

49. Which of the following statement is NOT correct in the case of LED?

(A) It is a heavily doped p-n junction diode.

(B) It emits light only when it is forward biased.

(C) It emits light only when it is reverse biased.

(D) The energy of the light emitted is equal to or slightly less than the energy gap of the semiconductor used.

(A) A

(B) B

(C) C

(D) D

50. In which of the logic gate the following statement is true? "The output is high when either of the inputs is high but not if both inputs are high"

(A) NAND

(B) NOR

(C) X-OR

(D) OR

Chemistry

Questions 51 to 100 | 1 mark each | 50 marks

51. The ratio of mass of 'x' atoms of an element to mass of carbon atoms is 9:1. Find the mass of 1 mol of x if molar mass of carbon is 12 g/mol.

(A) 54g

(B) 108g

(C) 180g

(D) 216g

52. What is the number of unpaired electrons present in ground state of Silicon and Chromium, respectively ?

(A) 2 and 4

(B) 2 and 6

(C) 0 and 6

(D) 4 and 5

53. Identify the most electronegative element by the following.

(A) Oxygen

(B) Nitrogen

(C) Fluorine

(D) Chlorine

54. What is the total number of electrons present in bonding and antibonding orbitals respectively in F_2 molecule according to MO theory ?

(A) Bonding - 8, Antibonding - 10

(B) Bonding - 6, Antibonding - 12

(C) Bonding - 10, Antibonding - 8

(D) Bonding - 12, Antibonding - 6

55. At constant temperature, a gas occupies a volume of 200 mL at a pressure of 500 mm Hg. What will be its volume at 800 mm Hg pressure?

(A) 280mL

(B) 125mL

(C) 100mL

(D) 350mL

56. Which of the following statements is not correct ?

(A) ΔG° is an extensive property.

(B) E° cell is an intensive property.

(C) For a chemical reaction to be spontaneous ΔG must be $-$ve.

(D) Electrical work is equal to ΔG

57. The heat of combustion of carbon to CO_2 is $-393.5 kJ/mol$. The heat released upon formation of 35.2 g of CO_2 from carbon and oxygen gas is

(A) $+315\text{kJ}$

(B) -315kJ

(C) -3.15kJ

(D) -630kJ

58. Calculate the enthalpy change when 6 g. CO(g) reacts with sufficient $\text{NO}_2\text{(g)}$ according to the following reaction

$4\,\text{CO(g)} + 2\,\text{NO}_2\text{(g)} \rightarrow 4\,\text{CO}_2\text{(g)} + 2\text{N}_2\text{(g)}\,;\Delta_r H^0 = -1200\text{kJ}$

(A) -16.08kJ.

(B) -32.15kJ.

(C) -64.29kJ

(D) -128.58kJ.

59. Identify the process that proceeds with no heat exchange between system and surrounding.

(A) Isothermal

(B) Isobaric

(C) Isochoric

(D) Adiabatic

60. The solubility product of sparingly soluble salt BA is 4×10^{-13}. Calculate the $[\text{A}^-]$ if $[\text{B}^+]$ is $1 \times 10^{-6}\text{M}$.

(A) $2 \times 10^{-7}M$

(B) $3 \times 10^{-7}M$

(C) $4 \times 10^{-7}M$

(D) $5 \times 10^{-7}M$

61. Which of the following salt undergoes anionic hydrolysis ?

(A) $CuSO_4$

(B) Na_2CO_3

(C) NH_4Cl

(D) $FeCl_3$

62. Identify from the following salts an example of a salt of strong acid and weak base.

(A) Ammonium acetate.

(B) Sodium acetate.

(C) Copper (II) chloride.

(D) Sodium carbonate.

63. What is oxidation state of chlorine in chlorous acid?

(A) +2

(B) +4

(C) +3

(D) +7

64. Which of the following phenomena represents oxidation?

(A) Removal of oxygen

(B) Addition of electronegative element

(C) Addition of electropositive element

(D) Gain of electron

65. What is the role of glycerol in the decomposition of hydrogen peroxide?

(A) It increases the reaction rate.

(B) It reduces the reaction rate.

(C) It increases the enthalpy of the reaction.

(D) It increases the rate of collisions between reactant molecules.

66. Which of the following statements is NOT correct regarding dihydrogen?

(A) It is colorless and tasteless gas.

(B) It burns with a pale blue flame.

(C) It is a polar water-soluble gas.

(D) It is lighter than air.

67. Which of following has the highest nucleophilicity ?

(A) F^-

(B) OH^-

(C) CH_3^-

(D) NH_2^-

68. Identify the catalyst used in the Friedel crafts acylation reaction.

(A) Anhydrous $AlCl_3$

(B) Anhydrous $FeCl_3$

(C) $NaNO_2$

(D) Alcoholic KOH

69. Identify the use of Baeyer's reagent by the following.

(A) Detecting the presence of carbon carbon double bond.

(B) Polymerisation

(C) Oxidation

(D) Reduction

70. What is the total contribution of all corner particles in bcc unit cell?

(A) 1 particle

(B) 2 particles

(C) 3 particles

(D) 4 particles

71. When silver crystallizes, it forms face centered cubic cells, if the volume of unit cells $6.84 \times 10^{-23} \text{cm}^3$. Calculate the density of silver. (Molar mass of silver is 108 g/mol, $N_A = 6.022 \times 10^{23}$)

(A) 12.49gm cm^{-3}

(B) 10.49gm cm^{-3}

(C) 16.89gm cm^{-3}

(D) 20.49gm cm^{-3}

72. What is the coordination number of Ag in a crystal lattice?

(A) 4

(B) 6

(C) 12

(D) 8

73. The normal boiling point of Ethyl acetate is 77°C. A solution of non-volatile non-electrolyte solute in ethyl acetate boils at 78°C. K_b for ethyl acetate is $2.77 \text{°C kg mol}^{-1}$. What is the molality of the solution ?

(A) 0.361m

(B) 0.052m

(C) 0.075m

(D) 0.25m

74. 18 g of glucose (molar mass = 180 g/mol) is dissolved in water to prepare 500 ml solution at 15°C. Calculate the osmotic pressure of the solution. $[R = 0.0821 \text{L atm K}^{-1}\text{mol}^{-1}]$

(A) 1.65atm

(B) 4.73atm

(C) 5.57atm

(D) 2.34atm

75. What type of solution is a brass ?

(A) solid in solid

(B) liquid in solid

(C) gas in solid

(D) liquid in gas

76. What mass of silver (Atomic mass = 108 g/mol) deposited by a quantity of electricity which displaces 5600 mL of O_2 at STP ?

(A) 5.4g

(B) 10.8g

(C) 54.0g

(D) 108.0g

77. Which of the following reactions takes place at anode during the electrolysis of molten NaCl?

(A) $Na^+_{(l)} + e^- \rightarrow Na_{(l)}$

(B) $Na_{(s)} \rightarrow Na^+_{(l)} + e^-$

(C) $Cl_{2(g)} + 2e^- \rightarrow 2Cl^-_{(l)}$

(D) $2Cl^-_{(l)} \rightarrow Cl_{2(g)} + 2e^-$

78. The rate law for the reaction $A + B \rightarrow P$ is found to be rate $= k[A]^2[B]$. The rate constant of the reaction at 300 K is $6.0\text{M}^{-2}\text{s}^{-1}$. Calculate the rate of the reaction when $[A] = 1\text{M}$ and $[B] = 0.2\text{M}$

(A) 0.6M s^{-1}.

(B) 1.2M s^{-1}.

(C) 1.8M s^{-1}.

(D) 2.4M s^{-1}.

79. If for a first-order reaction, $[A]_0 = 1.0\text{M}$ and $[A]_t = 0.25\text{M}$ after 276 s, find the value of the rate constant (k).

(A) 0.0021s^{-1}

(B) 0.0050s^{-1}

(C) 0.003s^{-1}

(D) 0.006s^{-1}

80. The equation for the rate constant is $k = Ae^{-E_a/RT}$.
A chemical reaction will proceed more rapidly if there is a decrease in

(A) k

(B) A

(C) E_a

(D) T

81. What is the oxidation state of chromium in the final product when KI reacts with acidified potassium dichromate solution?

(A) +2

(B) +3

(C) +6

(D) +4

82. Which of the following series of transition elements has general electronic configuration, $[Kr]\,4d^{1-10}\,5s^{0-2}$?

(A) 3d series elements

(B) 4d series elements

(C) 5d series elements

(D) 6d series elements

83. Identify the ionization isomer of $[Cr(H_2O)_4\,Cl(NO_2)]\,Cl$ from the following.

(A) $[Cr(H_2O)_4\,(O_2N)]\,Cl_2$

(B) $[Cr(H_2O)_4\,Cl_2]\,(NO_2)$

(C) $[Cr(H_2O)_4\,Cl(ONO)]\,Cl$

(D) $[Cr(H_2O)_4\,Cl_2(NO_2)]\,H_2O$

84. The number of ligands which are directly bonded to the metal is known as

(A) co-ordination number

(B) oxidation number

(C) co-ordination sphere

(D) valency

85. Identify the reagent used for replacement of $-N_2^+Cl^-$ from benzene diazonium chloride by iodine.

(A) HI

(B) KOI

(C) KI

(D) PI_3

86. What is the product P obtained in following reaction?

$CH_3CH_2Br + AgCN_{(alc)} \rightarrow P$

(A) CH_3CH_2NC

(B) CH_3CH_2CN

(C) $CH_3CH_2CONH_2$

(D) $CH_3CH_2NH_2$

87. What is action of CH_3ONa on CH_3CH_2Br

$CH_3ONa + CH_3CH_2Br \rightarrow ?$

(A) Formation of $CH_3OCH_2CH_3 + NaBr$

(B) Formation of $CH_3OH + NaBr$

(C) Formation of CH_3CH_2OH

(D) Formation of $(CH_3)_2O$

88. Which of the following reagents limits the oxidation of $R\text{-}CH_2OH$ up to R-CHO only?

(A) PCC

(B) CrO_3

(C) $K_2Cr_2O_7$ / dil. H_2SO_4

(D) $KMnO_4$ (acidic)

89. Which of the following ether, on hydrolysis, gives two different products that are successive members of the homologous series?

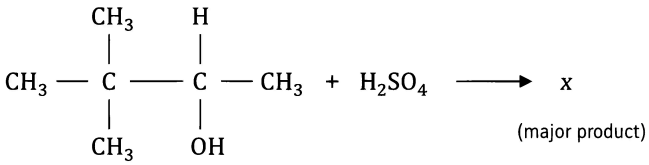
(A) Methoxymethane

(B) Methoxypropane

(C) Ethoxypropane

(D) 1-Methoxypropane

90. Identify the product X in the following reaction.



(A) 2,3-dimethyl-2-butene

(B) 3,2-diethyl butene

(C) 3,3-dimethyl-1-butene

(D) 2,2-diethyl butene

91. Acetone on heating with CrO_3 mainly forms,

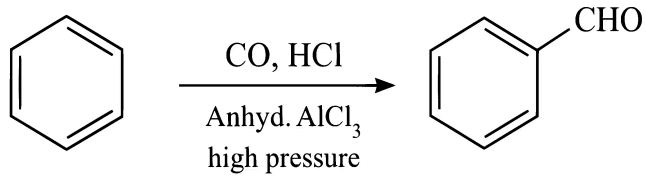
(A) Acetic acid

(B) Ethyl alcohol

(C) Toluene

(D) Dimethyl ether

92. Identify the name of the above reaction.



(Benzene) (Benzaldehyde)

(A) Etard reaction

(B) Gatterman-Koch formylation reaction

(C) Stephen reaction

(D) Rosenmund reaction

93. When sodium bicarbonate is added to an organic compound, brisk effervescences is evolved. This indicate the presence of which functional group.

(A) $-CHO$

(B) $-C=O$

(C) $-COCl$

(D) $-COOH$

94. Tertiary amines have the lowest boiling points because ,

(A) They possess polar N-C bonds

(B) They possess inter-molecular dipole-dipole attraction forces.

(C) They possess inter-molecular H-bonding

(D) They do not possess inter-molecular H- bonding

95. Which of the following molecules is capable of forming Zwitter ion?

(A) NH_2CH_2COOH

(B) CH_3COOH

(C) $CH_3CH_2NH_2$

(D) CCl_3NO_2

96. The letter 'D' in carbohydrates signifies

(A) dextrorotatory

(B) configuration

(C) diamagnetic nature

(D) mode of synthesis

97. Which of the following is found to raise the HDL level in the blood?

(A) Omega-6 fatty acids

(B) Omega-3 fatty acids

(C) Trans fats

(D) Cis fats

98. Identify the polymer used to prepare plastic bottles needed to store cooking oil.

(A) PVC

(B) PS

(C) LDPE

(D) PET

99. Which polymer is commonly used in nonstick cookwares ?

(A) PVC

(B) Teflon

(C) SBR

(D) Buna -S

100. Buna-S is prepared from

(A) 1, 3- butadiene and vinyl cyanide

(B) 1, 3- butadiene and styrene

(C) 1,2 -butadiene and vinyl cyanide

(D) 1, 2-butadiene and styrene

Mathematics

Questions 101 to 150 | 2 marks each | 100 marks

101. If n is a positive integer, then $(1+i\sqrt{3})^{2n}+(1-i\sqrt{3})^{2n}$ is equal to .....

(A) $2^{2n+1}cos(\frac{2n\pi}{3})$

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

(C) $2^{2n+1}cos(\frac{n\pi}{3})$

(D) $2^{n}cos(\frac{2n\pi}{3})$

102. The number of 4-letter words formed from the English alphabet such that there are exactly 2 vowels and 2 consonants and no vowel is repeated, but consonants may be repeated is:

(A) ${}^4C_2 \times {}^5C_2 \times (21)^2$

(B) ${}^4C_2 \times {}^5C_2 \times {}^{21}C_2$

(C) ${}^4C_2 \times {}^5P_2 \times {}^{21}P_2$

(D) ${}^4C_2 \times {}^5P_2 \times (21)^2$

103. The value of $cos(60^\circ - A) \cdot cosA \cdot cos(60^\circ + A)$ is

(A) $\frac{1}{4}cos3A$

(B) $sin3A$

(C) $cos3A$

(D) $\frac{1}{4}sin3A$

104. The general solution of the equation $cot\theta \cdot cot2\theta = 1$ is...

(A) $\theta = n\pi \pm \frac{\pi}{6}, n \in Z$

(B) $\theta = n\pi \pm \frac{\pi}{3}, n \in Z$

(C) $\theta = n\pi \pm \frac{\pi}{4}, n \in Z$

(D) $\theta = n\pi \pm \frac{\pi}{8}, n \in Z$

105. The line $(2 + k)x + (1 + k)y = 5 + 7k$ passes through the fixed point for different values of k. If 'd' is the distance of a fixed point from the origin, then $d^2 = ...$

(A) 29

(B) 37

(C) 65

(D) 85

106. If θ is the acute angle between the lines $2x^2 + 7xy + 3y^2 = 0$, then the value of $\frac{2cos\theta - 3sin\theta}{4sin\theta + 5cos\theta} = ...$

(A) 1

(B) $\frac{5}{9}$

(C) $-\frac{1}{9}$

(D) $\frac{1}{9}$

107. The combined equation of the pair of lines passing through the origin and making an angle $\frac{\pi}{4}$ with the line $3x + y - 6 = 0$ is...

(A) $x^2 + 3xy - 2y^2 = 0$

(B) $2x^2 - 3xy + y^2 = 0$

(C) $2x^2 - xy + 3y^2 = 0$

(D) $2x^2 + 3xy - 2y^2 = 0$

108. Line $l : x + y = 4$ intersects the circle $x^2 + y^2 - 2x - 2y = 2$ at points A and B. If C is the center of the circle, then the area of $\triangle ABC$ is...

(A) $\sqrt{2}$

(B) 2

(C) $2\sqrt{2}$

(D) 4

109. If $\lim\limits_{x \to 0} \frac{45^x - 9^x - 5^x + 1}{(k^x - 1)(3^x - 1)} = 2$, then the value of k is ...

(A) 45

(B) 9

(C) 5

(D) 3

110. If the truth value of the compound statement $[(p \leftrightarrow q) \wedge (q \rightarrow r) \wedge \sim r] \rightarrow (p \wedge \sim q)$ is false, then the truth values of the statement patterns $(p \rightarrow q) \leftrightarrow (q \rightarrow r)$ and $\sim (p \vee r) \rightarrow (q \wedge p)$ are, respectively ...

(A) (T, T)

(B) (T, F)

(C) (F, T)

(D) (F, F)

111. The negation of the contrapositive of the statement $(p \vee \sim q) \rightarrow (p \wedge \sim q)$ is

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

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

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

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

112. In triangle ABC, with usual notations, if $a = 4, b = 5$ and $c = 6$, then angle C is equal to...

(A) A

(B) $2A$

(C) $3A$

(D) $\frac{A}{2}$

113. If $A = \begin{bmatrix} 2 & 3 \\ 5 & -2 \end{bmatrix}$, $B^{-1} = \begin{bmatrix} \frac{1}{5} & \frac{2}{5} \\ \frac{2}{5} & -\frac{1}{5} \end{bmatrix}$, then $(AB)^{-1} =$

(A) $\frac{1}{95}\begin{bmatrix} 8 & -1 \\ -1 & 12 \end{bmatrix}$

(B) $\frac{1}{95}\begin{bmatrix} 12 & -1 \\ -1 & 8 \end{bmatrix}$

(C) $\frac{1}{95}\begin{bmatrix} -12 & 1 \\ 1 & -8 \end{bmatrix}$

(D) $\frac{1}{95}\begin{bmatrix} -8 & 1 \\ 1 & -12 \end{bmatrix}$

114. If $A = [a_{ij}]_{3\times3}$ is a matrix such that $a_{ij} = |2i - 5j|$, where $|.|$ denotes the modulus function, then the element in the 2^{nd} row and 3^{rd} column of A^{-1} is ...

(A) 3

(B) 1

(C) 0

(D) -1

115. If $A = \begin{bmatrix} 2 & -1 \\ 0 & 2 \end{bmatrix}$ and $A^2 + xA + yI_2 = O_2$, where I_2 and O_2 are the identity matrix and null matrix of order 2 respectively, then:

(A) $x = 4, y = 4$

(B) $x = -4, y = 4$

(C) $x = -4, y = -2$

(D) $x = 4, y = -4$

116. The value of $cot^{-1}[\frac{\sqrt{1-sinx}+\sqrt{1+sinx}}{\sqrt{1-sinx}-\sqrt{1+sinx}}]$, where $x \in (0, \frac{\pi}{2})$ is...

(A) $\pi - x$

(B) $2\pi - x$

(C) $\frac{\pi}{2} - \frac{x}{2}$

(D) $\pi - \frac{x}{2}$

117. If $(tan^{-1}x)^2 + (cot^{-1}x)^2 = \frac{5\pi^2}{8}$, then the value of x is equal to...

(A) -1

(B) -2

(C) 1

(D) 2

118. If $f(\frac{x-1}{x+1}) = x + 1$, then $\int f(x)\,dx = \cdots$

(A) $2log|1 - x| + c$

(B) $-2log|1 - x| + c$

(C) $2log|1 + x| + c$

(D) $-2log|1 + x| + c$

119. If $e^x + e^{f(x)} = e$, then the domain of $f(x)$ is

(A) $(1, \infty)$

(B) $(-\infty, 1)$

(C) $(-\infty, \infty)$

(D) $(-\infty, 0)$

120. If the function f is continuous at $x = \pi$, where $f(x) = \frac{1-cos[7(x-\pi)]}{5(x-\pi)^2}$, for $x \neq \pi$, then $f(\pi) =$

(A) $\frac{49}{4}$

(B) $\frac{4}{49}$

(C) $\frac{49}{10}$

(D) $\frac{10}{49}$

121. Let f(x) be a twice differentiable function such that $f''(x) = -f(x)$, Missing open brace for superscript and $h(x) = \{f(x)\}^2 + \{g(x)\}^2$. If $h(5) = 11$, then $h(10)$ is equal to ...

(A) 11

(B) 22

(C) 0

(D) Not defined

122. If $cot[f(x)] = \frac{3x-x^3}{1-3x^2}$ and $sin[g(x)] = \frac{1-x^2}{1+x^2}$, then $\lim_{x \to t} \frac{f(x)-f(t)}{g(x)-g(t)} = ...$

(A) $\frac{3}{2(1+t^2)}$

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

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

(D) $-\frac{5}{2(1+t^2)}$

123. If $y = cos^{-1}(\frac{1-4^x}{1+4^x})$, then $\frac{dy}{dx}$ at $x = 1$ is

(A) $\frac{4log2}{5}$

(B) $\frac{log2}{5}$

(C) $\frac{2log8}{5}$

(D) $\frac{5log8}{2}$

124. A cylindrical tank without a top lid is being manufactured to hold a fixed volume of 125π cubic cm. The minimum surface area required to construct this tank is .....square cm

(A) 75π

(B) 50π

(C) 25π

(D) 125π

125. A spherical snow ball is melting so that its volume is decreasing at the rate of 8 c.c./sec then the rate of change of radius when the radius is 2 cm, is :

(A) The radius is increasing at the rate of $\frac{1}{2\pi}$cm/s

(B) The radius is decreasing at the rate of $\frac{1}{2\pi}$cm/s

(C) The radius is increasing at the rate of $\frac{1}{\pi}$cm/s

(D) The radius is decreasing at the rate of $\frac{1}{\pi}$cm/s

126. The equation of tangent to the curves $x = 1 - 3t^2$ and $y = t - 3t^3$ at the point $(-2, 2)$ is...

(A) $4x + 3y + 2 = 0$

(B) $4x - 3y + 2 = 0$

(C) $3x + 4y + 2 = 0$

(D) $3x - 4y + 2 = 0$

127. If $f(x) = cosx$, then the value of $\int \frac{e^{f(x)}(xsin^3x+f(x))}{1-(f(x))^2}dx =$

(A) $e^{f(x)}(-\text{cosec}x - x) + c$

(B) $e^{f(x)}(\text{cosec}\, x + x) + c$

(C) $e^{f(x)}(cosx - x) + c$

(D) $e^{f(x)}(cot^2x + x) + c$

128. $\int \frac{x^4+1}{x^6+1}dx =$

(A) $tan^{-1}x - \frac{1}{3}tan^{-1}(x^3) + c$

(B) $tan^{-1}x + \frac{1}{3}tan^{-1}(x^3) + c$

(C) $tan^{-1}x - tan^{-1}(x^3) + c$

(D) $tan^{-1}x + tan^{-1}(x^3) + c$

129. If $a > 0, b > 0$ and $\int \frac{1}{ax^2+b}dx = \frac{1}{\sqrt{6}}tan^{-1}(\frac{\sqrt{2}x}{\sqrt{3}}) + c$, then $\int \frac{1}{bx^2+a}dx$ = ...

(A) $-\frac{1}{\sqrt{6}}tan^{-1}(\frac{\sqrt{2}x}{\sqrt{3}}) + c$

(B) $\frac{1}{\sqrt{6}}tan^{-1}(\frac{\sqrt{3}x}{\sqrt{2}}) + c$

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

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

130. The value of integral $\int_0^1 cot^{-1}(1+x^2-x)\,dx$ is...

(A) $\frac{\pi}{2} - log2$

(B) $\pi - log2$

(C) $\frac{\pi}{4} - log2$

(D) $2\pi - log2$

131. The value of $\int_{-\pi}^{\pi} \frac{2x(1+sinx)}{1+cos^2x}dx$ is...

(A) $-\sqrt{2}\pi^2$

(B) π^2

(C) $\frac{\pi^2}{\sqrt{2}}$

(D) $-\frac{\pi^2}{\sqrt{2}}$

132. The area of the region enclosed by the lines $y = 2x, 2y = x$ and $x = 2$ (in sq.units) is...

(A) 1

(B) 2

(C) 3

(D) 4

133. The area of the region common to the parabolas $4y^2 = 9x$ and $3x^2 = 16y$ is...

(A) 2 sq. units

(B) 4 sq. units

(C) 8 sq. units

(D) 16 sq. units

134. For the differential equation $\frac{d^3y}{dx^3} + cos(\frac{d^2y}{dx^2}) = 0$, which of the following is true ?

(A) Order = 3, degree = 1

(B) Order = 3, degree = 2

(C) Order = 3, degree is not defined

(D) Order = 2, degree is not defined

135. If water at 100°C cools in 10 minutes to 80°C and to 65°C in the next 10 minutes, then the room temperature will be ...

(A) 30°C

(B) 15°C

(C) 25°C

(D) 20°C

136. The equation of the curve passing through the point (0, 1) and having a slope of the tangent at point $P(x, y)$ is equal to $\frac{y}{x+y}$, is

(A) $x = e^{-\frac{y}{x}}$

(B) $y = e^{-\frac{y}{x}} + 1$

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

(D) $y = e^{\frac{x}{y}}$

137. If $f(x)$ is a polynomial such that Missing open brace for superscript and $f(2) = 0$, then $f(-2) = \ldots$

(A) 1

(B) -1

(C) 4

(D) -4

138. The equation of a line in cartesian form passing through (0, 0, 0) and (4, 3, c) and parallel to $\vec{a} \times \vec{b}$ where $\vec{a} = 2\hat{i} + \hat{j} + 2\hat{k}$, $\vec{b} = 3\hat{i} - 4\hat{j}$ is

(A) $\frac{x-4}{8} = \frac{y-3}{6} = \frac{z+\frac{11}{2}}{11}$

(B) $\frac{x-4}{8} = \frac{y+3}{6} = \frac{z+\frac{11}{2}}{-11}$

(C) $\frac{x-4}{8} = \frac{y-3}{6} = \frac{z+\frac{11}{2}}{-11}$

(D) $\frac{x+4}{8} = \frac{y-3}{6} = \frac{z+\frac{11}{2}}{-11}$

139. If $\bar{a} = 4\hat{i} + \hat{j} + \hat{k}$, $\bar{b} = 2\hat{i} + \hat{j} + 2\hat{k}$ and $\bar{c} = 3\hat{i} + 4\hat{j} + 5\hat{k}$, then $(\bar{a} + \bar{b}) \cdot (\bar{b} + \bar{c}) =$

(A) 30

(B) 21

(C) 61

(D) 10

140. If $\bar{a} = 2\hat{i} + \hat{j} - \hat{k}, \bar{b} = \hat{i} + 3\hat{k}$ and $\bar{c}$ is a unit vector, then the maximum value of the scalar triple product $[\bar{a}\bar{b}\bar{c}]$ is

(A) $\sqrt{10} + \sqrt{6}$

(B) $\sqrt{10}$

(C) $\sqrt{6}$

(D) $\sqrt{59}$

141. Let $\bar{a}, \bar{b}$ and $\bar{c}$ be three coplanar unit vectors. A unit vector $\bar{d}$ is perpendicular to them. If $(\bar{a} \times \bar{b}) \times (\bar{c} \times \bar{d}) = \frac{3}{26}\hat{i} - \frac{2}{13}\hat{j} + \frac{6}{13}\hat{k}$ and the angle between $\bar{a}$ and $\bar{b}$ is $30°$, then $\bar{c}$ is equal to...

(A) $\frac{3}{13}\hat{i} - \frac{4}{13}\hat{j} + \frac{12}{13}\hat{k}$

(B) $\frac{3}{13}\hat{i} - \frac{2}{13}\hat{j} + \frac{6}{13}\hat{k}$

(C) $\frac{3}{26}\hat{i} - \frac{4}{13}\hat{j} + \frac{12}{13}\hat{k}$

(D) $\frac{3}{26}\hat{i} - \frac{3}{26}\hat{j} + \frac{5}{26}\hat{k}$

142. The volume of a parallelopiped with coterminous edges $\bar{a}, \bar{b}, \bar{c}$ is 3 cubic units. The volume (in cubic units) of a tetrahedron with coterminous edges $(\bar{a} \times \bar{b}), (\bar{a} \times 2\bar{c}), (\bar{b} \times 2\bar{c})$ is...

(A) 6

(B) 12

(C) 24

(D) 36

143. If the lines $2x = ky = -z$ and $6x = -y = -4z$ are perpendicular to each other then the value of k is ...

(A) 16

(B) 5

(C) 10

(D) 3

144. The vector equation of plane in parametric form, passing through the points (-1, 2, 0), (2, 2, -1) and parallel to the line $\frac{x-1}{1} = \frac{2y+1}{2} = \frac{z+1}{-1}$ is

(A) $\bar{r} = (-\hat{i} + 2\hat{j}) + \lambda(3\hat{i} - \hat{k}) + \mu(\hat{i} + \hat{j} - \hat{k})$

(B) $\bar{r} = (-\hat{i} + 2\hat{j}) + \lambda(3\hat{i} - \hat{k}) + \mu(\hat{i} + 2\hat{j} - \hat{k})$

(C) $\bar{r} = (\hat{i} - 2\hat{j}) + \lambda(3\hat{i} + \hat{k}) + \mu(\hat{i} + \hat{j} - \hat{k})$

(D) $\bar{r} = (-\hat{i} + 2\hat{j}) + \lambda(3\hat{i} - \hat{k}) + \mu(\hat{i} - \hat{j} + \hat{k})$

145. If d is the distance of point (2, 5, 10) from the plane containing the lines $\bar{r} = (4\hat{j} - \hat{k}) + \lambda(\hat{i} + 2\hat{j} - 2\hat{k})$ and $\bar{r} = (2\hat{i} + \hat{j}) + \mu(\hat{i} + 2\hat{j} - 2\hat{k})$, then d^2 =

(A) 145

(B) 13

(C) 90

(D) 79

146. The values of p and q so that the line joining the points (7, p, 2) and (q, -2, 5) may be parallel to the line joining the points (2, -3, 5) and (-6, -15, 11) are

(A) $p = 4, q = -3$

(B) $p = 4, q = 3$

(C) $p = -4, q = 3$

(D) $p = -4, q = -3$

147. The minimum value of $z = 3x + 5y$, subject to constraints $x \leq 80$, $y \geq 60$, $x + y \leq 200$ & $x, y \geq 0$ occurs at the point...

(A) $(0, 200)$

(B) $(60, 0)$

(C) $(0, 60)$

(D) $(80, 60)$

148. If a fair coin is tossed 8 times, then the probability of getting at most 2 heads is...

(A) $\frac{37}{64}$

(B) $\frac{37}{256}$

(C) $\frac{37}{128}$

(D) $\frac{37}{512}$

149. If a random variable X has a probability mass function $P(x) = \begin{cases} kx^2, & \text{for } x = 1, 2, 3, 4 \\ 0, & \text{otherwise} \end{cases}$, then the mean of X is ...

(A) 3.232

(B) 2.221

(C) 3.333

(D) 2.222

150. If E_1 and E_2 are equally likely, mutually exclusive and exhaustive events and $P(A|E_1) = 0.2$, $P(A|E_2) = 0.3$, then $P(E_1|A)$ equal to...

(A) $\frac{1}{5}$

(B) $\frac{4}{5}$

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

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