MHT CET 2026 PCM Question Paper April 20 Shift 1

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 area of parallelogram formed by vectors $\vec{P} = 2\hat{i} - \hat{j} + 5\hat{k}$ and $\vec{Q} = 3\hat{i} - 2\hat{j} + 4\hat{k}$ is

(A) $\sqrt{72}$

(B) $\sqrt{86}$

(C) $\sqrt{104}$

(D) $\sqrt{240}$

2. The percentage error in the measurement of mass of a body and its speed are 0.73% and 1.84% respectively. The percentage error in the measurement of its momentum and kinetic energy are respectively

(A) 2.57% , 2.75%

(B) 2.57% , 4.41%

(C) 1.46% , 1.84%

(D) 1.84% , 3.70%

3. A boat crosses a river from one bank A to another bank B which is opposite. The distance between them is D. The speed of water is V_W and that of boat relative to water is V_B. If $V_B = 2V_W$, the time taken by the boat to cross the river directly along AB is $(sin30° = \frac{1}{2})$, $(cos30° = \frac{\sqrt{3}}{2})$

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

(B) $\frac{D\sqrt{2}}{V_B}$

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

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

4. The weight of man in lift moving in upward direction with an acceleration 'a' is 660 N. When the lift moves in the downward direction with the same acceleration, his weight is found to be 380 N. The real weight of the man when the lift is at rest is

(A) 400 N

(B) 460 N

(C) 520 N

(D) 640 N

5. A solid sphere rolls down from the top of an inclined plane. On reaching the bottom of the plane, its velocity is 'V_1'. When the same sphere slides down from the top of the same plane of same height, its velocity on reaching the bottom is 'V_2'. The ratio $V_1 : V_2$ is (neglect friction)

(A) $\sqrt{7} : \sqrt{5}$

(B) $\sqrt{7} : \sqrt{3}$

(C) $\sqrt{3} : \sqrt{5}$

(D) $\sqrt{5} : \sqrt{7}$

6. Two identical rings A and B of same mass and radius are revolving, ring A arounds its own diameter and ring B about tangential axis in its own plane. Both the rings A and B have same rotational kinetic energy. The ratio of the angular velocity of ring B to that of ring A is

(A) $1 : 3$

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

(C) $3 : 2$

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

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

(A) $\frac{x}{2y}$

(B) $\frac{y}{2x}$

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

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

8. The percentage decrease in the weight of a body when taken to a height of 48 km above the surface of the earth is (Radius of the earth is 6400 km)

(A) 1%

(B) 1.5%

(C) 2%

(D) 2.5%

9. If 450 erg of work is done in blowing a soap bubble of radius 'r', the additional work required to be done to blow it to a radius equal to $3r$ is

(A) 2400 erg

(B) 3000 erg

(C) 3600 erg

(D) 4000 erg

10. The excess pressure inside a soap bubble of radius 2.5 cm is 48 dyne/cm^2. The surface tension of soap solution in dyne /cm is

(A) 25

(B) 30

(C) 35

(D) 40

11. In case of liquid, if Reynold's number 'R_n' is 1450, then the flow of liquid will

(A) be streamline.

(B) be turbulent.

(C) change from streamline to turbulent flow.

(D) be sometimes turbulent and sometimes streamline.

12. A sphere is at temperature 600 K. In an external environment of 200 K, its cooling rate is R. When the temperature of the sphere falls to 400 K then cooling rate R' will become

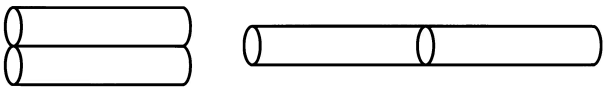
(A) $\frac{16}{3}R$

(B) $\frac{16}{9}R$

(C) $\frac{9}{16}R$

(D) $\frac{3}{16}R$

13. Two rods of same length, radius and material transfer a given amount of heat in 't' second when they are joined as shown in fig (1). But when they are joined as shown in fig (2) then they will transfer same heat in same condition in time



(fig 1) (fig 2)

(A) $2t$

(B) $3t$

(C) $4t$

(D) $6t$

14. A rigid diatomic gas ($\gamma = \frac{7}{5}$) is compressed adiabatically to volume ($\frac{V_i}{32}$), where V_i is the initial volume. The initial temperature of the gas is 'T_i' K and the final temperature is '$x\,T_i$' K. The value of x is

(A) 2

(B) 3

(C) 4

(D) 5

15. An ideal rigid diatomic gas ($\gamma = \frac{7}{5}$) undergoes an adiabatic change . If the relation between temperature and volume is $TV^x =$ constant then the value of x is

(A) 0.25

(B) 0.30

(C) 0.40

(D) 0.60

16. Gas at pressure P, temperature T, and volume V is filled in jar A. Another jar B is filled with gas having parameters $2P$, $\frac{V}{4}$, $2T$. The ratio of number of molecules of jar B to those of jar A is

(A) 1 : 2

(B) 1 : 4

(C) 2 : 1

(D) 4 : 1

17. A simple pendulum of length l_1 has periodic time 2.4 s. Another simple pendulum of length $l_2 < l_1$, has periodic time 1.8 s. The periodic time of simple pendulum of length $(l_1 - l_2)$ is nearly

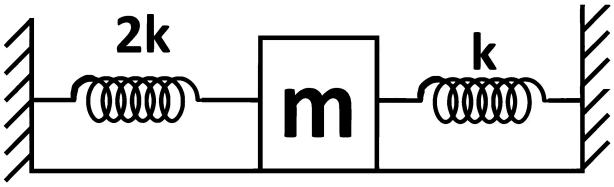
(A) 1.2 s

(B) 1.4 s

(C) 1.6 s

(D) 1.8 s

18. Two springs of force constants '$2k$' and 'k' are connected to a mass 'm' as shown. Mass is displaced slightly to one side and released. The frequency of oscillation of the two springs-mass system is



(A) $\frac{1}{2\pi}\sqrt{\frac{m}{k}}$

(B) $\frac{1}{2\pi}\sqrt{\frac{k}{m}}$

(C) $\frac{1}{2\pi}\sqrt{\frac{2k}{m}}$

(D) $\frac{1}{2\pi}\sqrt{\frac{3k}{m}}$

19. Two oscillating simple pendulums with time periods T and $\frac{4T}{3}$ are in phase at a given time. They will be again in phase after an elapse of time

(A) $5T$

(B) $4T$

(C) $3T$

(D) $2T$

20. A wire of length 'L', diameter 'd', density of material 'ρ' is under tension 'T' has fundamental frequency of vibration 'n_A'. Another wire of length '$2L$', diameter '$3d$', density of material '2ρ' is vibrated under tension '$2T$', the fundamental frequency of vibration becomes 'n_B'. The ratio n_B : n_A is

(A) 1 : 2

(B) 1 : 4

(C) 1 : 6

(D) 1 : 8

21. The 'Loudness' and 'Pitch' of sound respectively are the human perception to

(A) intensity of sound and frequency of sound.

(B) intensity of sound and velocity of sound.

(C) frequency of sound and velocity of sound.

(D) frequency of sound and intensity of sound.

22. A tuning fork of frequency 'n' is held near the open end of a tube which is dipped in water and length of the tube is adjusted until resonance occurs. If the two shortest lengths that produce resonance are l_1 and l_2, the speed of sound in air is (neglect end correction)

(A) $2n(l_2 - l_1)$

(B) $n(l_2 - l_1)$

(C) $\frac{n}{2}(l_2 - l_1)$

(D) $\frac{2n}{(l_2 - l_1)}$

23. The ratio of the speed of sound in helium gas to that in nitrogen gas at 295 K is (Ratio of specific heats γ for helium is $\frac{5}{3}$ and that for nitrogen is $\frac{7}{5}$. Molecular weight for helium and nitrogen are 4 and 28 respectively.)

(A) $\sqrt{\frac{2}{7}}$

(B) $\sqrt{\frac{3}{5}}$

(C) $\frac{\sqrt{3}}{5}$

(D) $\frac{5}{\sqrt{3}}$

24. A train is moving towards a stationary observer with speed 34 m/s. A train sounds a whistle of frequency 450 Hz. If the speed of sound is 340 m/s, the frequency heard by the observer in Hz is

(A) 440

(B) 480

(C) 500

(D) 540

25. Four electric charges $+q$, $+q$, $-q$, and $-q$ are placed in order at the corners of a square of side '$2r$'. The electric potential at a point midway between the two negative charges is

(A) $\frac{1}{4\pi\varepsilon_0}\frac{2q}{r}[\frac{1}{\sqrt{5}}-1]$

(B) $\frac{1}{4\pi\varepsilon_0}\frac{q}{r}[\frac{1}{\sqrt{5}}+1]$

(C) $\frac{1}{4\pi\varepsilon_0}\frac{2q}{r}[1-\sqrt{5}]$

(D) $\frac{1}{4\pi\varepsilon_0}\frac{q}{r}[1+\sqrt{5}]$

26. Two point charges q_1 and q_2 are 'l' distance apart. If one of the charges is doubled and the distance between them is halved. The magnitude of the force becomes 'n' times, where 'n' is

(A) 2

(B) 4

(C) 8

(D) 16

27. In a parallel plate air capacitor of plate separation 'd', a dielectric slab of thickness 't' is introduced between the plates. The capacitance becomes one-third of the original value. The dielectric constant of the slab will be

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

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

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

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

28. A parallel plate air capacitor having area of each plate 'A' and the distance between the plates 'd' has uniform electric field E in the space between the plates. The energy stored in the capacitor is (ε_0 = permittivity of free space.)

(A) $\frac{1}{2}\varepsilon_0 E^2$

(B) $\frac{1}{2}A\varepsilon_0 E$

(C) $\frac{1}{2}A\varepsilon_0 E^2 d$

(D) $\frac{1}{2}A\varepsilon_0^2 E \cdot d$

29. In meter bridge experiment, two resistances X and Y in the two gaps give a null point dividing the wire in the ratio $2 : 3$. When each resistance is increased by $30\,\Omega$, the null point divides the wire in the ratio $5 : 6$. The resistance X and Y are respectively

(A) $20\,\Omega$, $30\,\Omega$

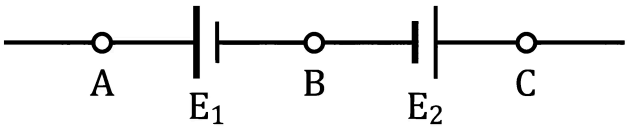
(B) $22\,\Omega$, $33\,\Omega$

(C) $32\,\Omega$, $48\,\Omega$

(D) $40\,\Omega$, $60\,\Omega$

30.

Two cells of e.m.f. E_1 and E_2 ($E_1 > E_2$) are connected as shown in figure.



When a potentiometer is connected between points A and B the balancing length of potentiometer wire is 412 cm. When same potentiometer wire is connected between points A and C the balancing length is 103 cm. The ratio $E_1 : E_2$ is

(A) 6 : 1

(B) 4 : 1

(C) 4 : 3

(D) 3 : 4

31. The periodic time of a magnet in vibration magnetometer is T_0. If a magnet is replaced by another magnet whose moment of inertia is three times and magnetic moment is one-third of the original magnet, then time period of new magnet will be

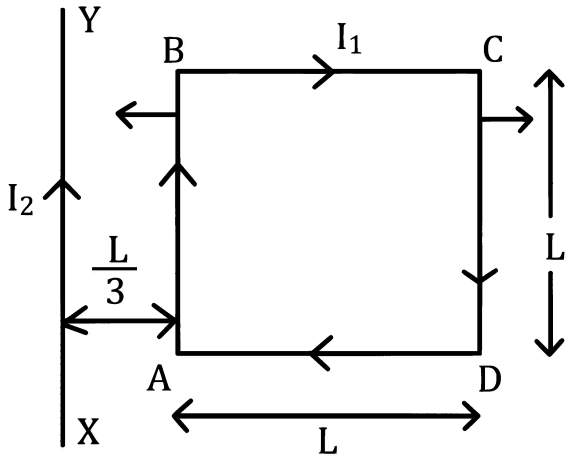
(A) $\frac{T_0}{3}$

(B) $\frac{T_0}{\sqrt{3}}$

(C) $3\,T_0$

(D) $\sqrt{3}\,T_0$

32. A square loop ABCD of side L carrying a current I_1 is placed at a distance $(L/3)$ from a conductor coplaner with a straight conductor XY carrying current I_2 as shown in figure. The net force on the loop will be (μ_0 = magnetic permeability)



(A) $\frac{\mu_0 I_1 I_2}{3\pi}$

(B) $\frac{3\mu_0 I_1 I_2}{8\pi}$

(C) $\frac{9\mu_0 I_1 I_2}{8\pi}$

(D) $\frac{3\mu_0 I_1 I_2}{4\pi}$

33. A long solenoid carrying a current produces a magnetic field 'B' along its axis. If the currunt is tripled and the number of turns per cm is halved then new value of magnetic field will be

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

(B) B

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

(D) $3B$

34. The self inductance of an air-core inductor (solenoid) is 0.03 mH. By introducing an iron core into inductor the self-inductance increases to 30 mH. The relative permeability of the core used is

(A) 10^{-3}

(B) 10^{-2}

(C) 10^{2}

(D) 10^{3}

35. A coil of effective area 3 m^2 is placed at right angles to a magnetic field of induction 0.05 Wb/m^2. If the field is decreased to 20% of its original value in 10 second, the e.m.f. induced in the coil will be

(A) 15 mV

(B) 12 mV

(C) 10 mV

(D) 5 mV

36. In a series LCR circuit, the voltage across R is 100 V, $R = 1\,K\Omega$ and $C = 2\,\mu F$. The angular frequency ω is 200 rad s^{-1}. At resonance, the voltage across 'L' is

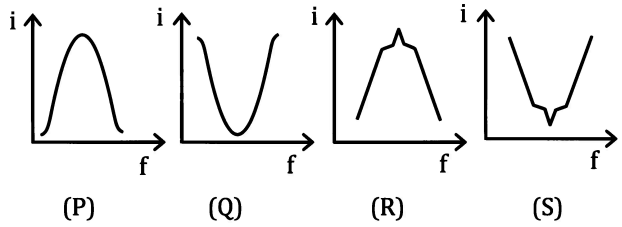
(A) 150 V

(B) 200 V

(C) 250 V

(D) 300 V

37. Which graph shows the correct variation of r.m.s. current 'i' with frequency 'f' of a.c. in case of series resonant circuit ?



(A) (R)

(B) (P)

(C) (S)

(D) (Q)

38. When an inductance 'L' and resistor 'R' are connected in series to 25V, 50 Hz supply, a current of 0.5 A flows in the circuit. The current lags behind in phase from applied voltage by $(\frac{\pi}{3})$ radian. The value of R is $(cos60° = \frac{1}{2})$

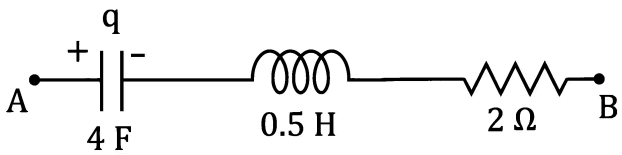
(A) $20\,\Omega$

(B) $25\,\Omega$

(C) $40\,\Omega$

(D) $50\,\Omega$

39. In the circuit shown charge q varies with time t as $q = t^2 - 5$, where q is in coulomb and t is in second. At time $t = 3$ second, voltage V_{AB} in volt will be



(A) 8

(B) 12

(C) 14

(D) 18

40. The prism has refracting angle A. The second refracting surface of the prism is silvered. Light ray falling on first refracting surface with angle of incidence $2A$, reaches the second surface and returns back through same path due to reflection at the silvered surface. The refractive index of the material of prism is

(A) $2sinA$

(B) $2cosA$

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

(D) $\frac{1}{2}cosA$

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

(A) 0.12×10^{-3} m

(B) 0.25×10^{-3} m

(C) 0.36×10^{-3} m

(D) 0.50×10^{-3} m

42. In an interference experiment, the m^{th} bright fringe for light of wavelength λ_1 coincides with the n^{th} dark fringe for light of wavelength λ_2 . The ratio $\frac{\lambda_2}{\lambda_1}$ is

(A) $\frac{m}{n-1}$

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

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

(D) $\frac{2m}{(2n+1)}$

43. In a biprism experiment, the distance between 4^{th} and 13^{th} bright band on the same side is 'y' when light of wavelength 6000 Å is used. For a light of wavelength 'λ' the distance between 6^{th} and 16^{th} bright band on the same side is again 'y'. The value of 'λ' in Å units is

(A) 6500

(B) 6300

(C) 5400

(D) 4800

44. The proton and α - particle are accelerated through same potential difference. Then the ratio of the de-Broglie wavelength of proton and α - particle is (mass of α-particle is 4 times mass of proton, charge of α-particle is 2 times charge of proton)

(A) $3\sqrt{3}$

(B) $3\sqrt{2}$

(C) $2\sqrt{3}$

(D) $2\sqrt{2}$

45. Two identical photocathodes receive light of frequencies n_1 and n_2. If the velocities of the emitted photoelectrons of mass m are V_1 and V_2 respectively, then (h = Planck's constant)

(A) $V_1 + V_2 = [\frac{2h}{m}(n_1 + n_2)]^{\frac{1}{2}}$

(B) $V_1 - V_2 = [\frac{2h}{m}(n_1 - n_2)]^{\frac{1}{2}}$

(C) $V_1^2 + V_2^2 = \frac{2h}{m}(n_1 + n_2)$

(D) $V_1^2 - V_2^2 = \frac{2h}{m}(n_1 - n_2)$

46. An electron in the hydrogen atom jumps from n^{th} energy state to the ground state. The wavelength so emitted illuminates a photosensitive material having work function **2.65** eV. If the maximum kinetic energy of the emitted photoelectrons is **10.1** eV, then the value of 'n' is

(A) 2

(B) 3

(C) 4

(D) 5

47. The angular momentum of an electron in Bohr's hydrogen atom having energy **(−0.544)** eV is
(h = Planck's constant)

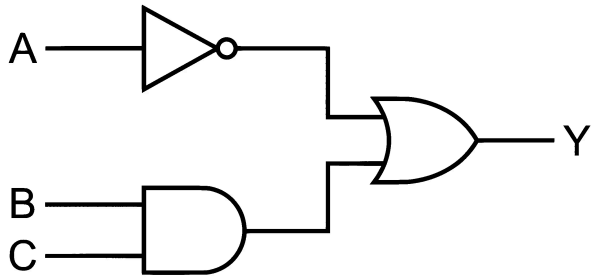
(A) $\frac{h}{\pi}$

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

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

(D) $\frac{7h}{2\pi}$

48. The output Y of the following digital logic circuit will be '1' (one) for the inputs



(A) $A = 1, B = 0, C = 0$

(B) $A = 1, B = 0, C = 1$

(C) $A = 1, B = 1, C = 0$

(D) $A = 1, B = 1, C = 1$

49. In a common emitter transistor amplifier, AC current gain is 65, the load resistance is $5400\,\Omega$ and input resistance of the transistor is $450\,\Omega$. The voltage gain is

(A) 460

(B) 540

(C) 780

(D) 7800

50. In the band structure of n-type semiconductor , the free electrons donated by impurity atoms occupy energy levels in

(A) the conduction band.

(B) the valence band.

(C) the band gap and are close to conduction band.

(D) the band gap and are close to valence band.

Chemistry

Questions 51 to 100 | 1 mark each | 50 marks

51. What is average atomic mass of chlorine if its two isotopes Cl^{35} and Cl^{37} exists in relative abundance of 75% and 25% respectively ?

(A) 35.0

(B) 35.5

(C) 37.0

(D) 37.5

52. What is the SI unit of luminous intensity ?

(A) Ampere

(B) Coulomb

(C) Candela

(D) Ohm

53. Which element from following has positive electron gain enthalpy?

(A) Xenon

(B) Bromine

(C) Iodine

(D) Chlorine

54. Identify linear molecule from following.

(A) SO_2

(B) BCl_3

(C) CO_2

(D) NH_3

55. Find the number of moles of CO_2 present in a sample occuping $4 \times 10^{-3}\ m^3$ at $1.104 \times 10^5\ Nm^{-2}$ pressure ($R \times T = 2208 J\ mol^{-1}$)

(A) 0.1 mole

(B) 0.2 mole

(C) 0.3 mole

(D) 0.4 mole

56. If 2 mole of an ideal gas expand isothermally and reversibly at 27°C from 1 dm^3 to $1m^3$ calculate work done? [$R = 8.314 J\ K^{-1} mol^{-1}$]

(A) -49.95 kJ

(B) -99.90 kJ

(C) -34.46 kJ

(D) -68.92 kJ

57. Identify the law for the statement "Overall the enthalpy change for a reaction is equal to sum of enthalpy changes of individual steps in the reaction"

(A) First law of thermodynamics

(B) Hess's law

(C) Avogadro's law

(D) Second law of thermodynamics

58. Calculate $\triangle G^{\circ}$ for reaction,

$CH_{4(g)} + H_{2(g)} \rightarrow C_2H_{6(g)}$ $(K_p = 2 \times 10^{17}, R = 8.314 JK^{-1}mol^{-1})$

(A) -64.695 kJ mol^{-1}

(B) -98.716 kJ mol^{-1}

(C) -44.08 kJ mol^{-1}

(D) -58.78 kJ mol^{-1}

59. What is the normal pH range of human blood?

(A) 6.0 to 6.4

(B) 7.36 to 7.42

(C) 6.4 to 6.95

(D) 7.8 to 8.0

60. Calculate the pOH of 0.01 M monobasic acid that is completely dissociated, at 298 K.

(A) 02

(B) 12

(C) 03

(D) 11

61. A weak monobasic acid is 4% dissociated in 0.05 M solution. What is percent dissociation in 0.1 M solution ?

(A) 5.715%

(B) 8.516%

(C) 2.828%

(D) 4.620%

62. What is the difference in oxidation number of nitrogen when nitric acid is converted into nitrous oxide ?

(A) +1

(B) +2

(C) +4

(D) +3

63. Which from following oxides is amphoteric in nature?

(A) BaO

(B) N_2O_5

(C) CO_2

(D) Al_2O_3

64. Identify the catalyst used to transform carbon monoxide from water gas into carbon dioxide

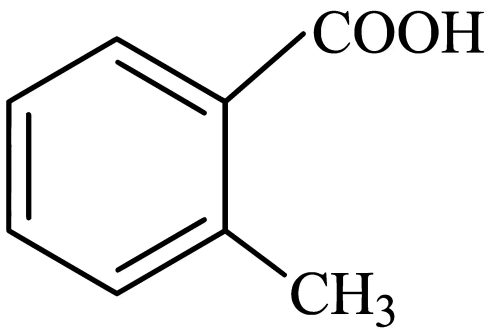
(A) Potassium dichromate

(B) Sodium chromate

(C) Iron chromate

(D) Nickel

65. What is IUPAC name of following compound?



(A) Benzoic acid

(B) 2-Methylbenzoic acid

(C) o-Toluic acid

(D) 2-Methylcyclohexylcarboxylic acid

66. Which from following is a correct priority order for selection of principal functional group for nomenclature of polyfunctional compound according to IUPAC system ?

(A) $-CHO > -CONH_2 > -OH > -C \equiv C-$

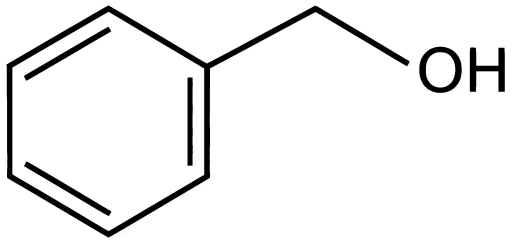
(B) $-CONH_2 > -CHO > -OH > -C \equiv C-$

(C) $-C \equiv C- > -OH > -CONH_2 > -CHO$

(D) $-C \equiv C- > -CHO > -CONH_2 > -OH$

67. Which of the following is tertiary benzylic alcohol?

(A)



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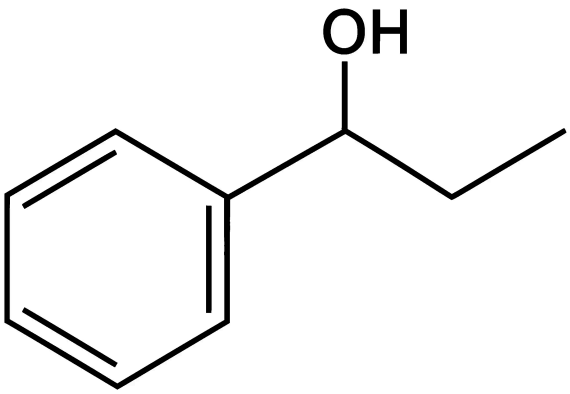

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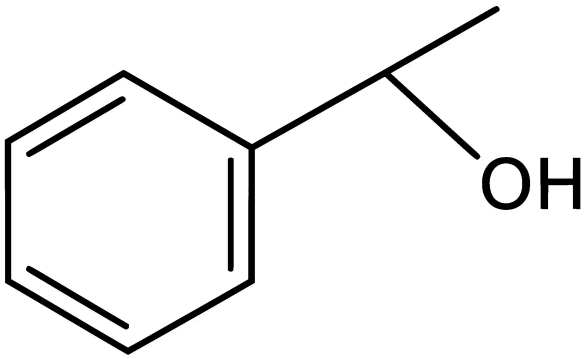
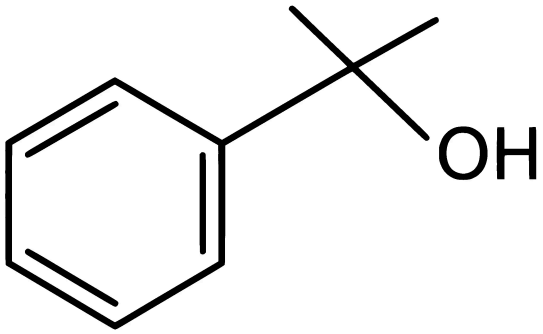
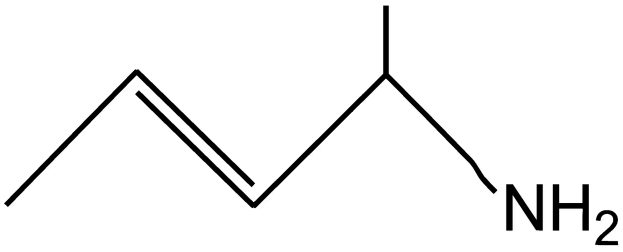


(D)



68. What is IUPAC name of the following compound ?



(A) Pent-2-en-4-amine

(B) Pent-3-en-2-amine

(C) 1-Methylbut-2-en-1-amine

(D) 4-Methylbut-2-en-4-amine

69. Which of the following alkenes on oxidation by $KMnO_4$ in dil H_2SO_4 forms adipic acid ?

(A) Hex-1-ene

(B) Hex-2-ene

(C) Hex-3-ene

(D) Cyclohexene

70. Calculate the radius of atom of metal forming fcc unit cell having edge length 360 pm

(A) 180.04 pm

(B) 127.26 pm

(C) 155.91 pm

(D) 254.67 pm

71. What is the coordination number of particle in simple cubic structure ?

(A) 2

(B) 4

(C) 6

(D) 12

72. Calculate the density of an element having molar mass 225g mol^{-1} forming bcc structure $[a^3 \times N_A = 75\text{cm}^3\text{mol}^{-1}]$

(A) $6.0\ \text{g cm}^{-3}$

(B) $2.81\ \text{g cm}^{-3}$

(C) $9.24\ \text{g cm}^{-3}$

(D) $11.36\ \text{g cm}^{-3}$

73. Calculate ΔT_b of a 0.45 m solution of a nonvolatile solute in solvent if molal elevation constant of solvent is $3.0\ \text{K kg mol}^{-1}$

(A) 0.94 K

(B) 2.69 K

(C) 3.21 K

(D) 1.35 K

74. Calculate the mass of nonvolatile solute dissolved in 0.3 dm^3 water having osmotic pressure 0.1 atm at 300K.
[Molar mass of solute = 328 g mol^{-1}, R = 0.082 dm^3atm $K^{-1}mol^{-1}$]

(A) 0.4 g

(B) 0.6 g

(C) 0.8 g

(D) 1.0 g

75. Which from following solutions in water on complete dissociation exhibits minimum freezing point depression?

(A) 0.2 m Potassium chloride

(B) 0.1 m Sodium chloride

(C) 0.05 m Aluminium phosphate

(D) 0.15 m Magnesium sulphate

76. Which of the following reactions occurs at cathode during recharging of lead accumulator ?

(A) Double subscripts: use braces to clarify

(B) $PbO_{2(s)} + 4H^{+}2e^{-} \rightarrow Pb^{2+} + 2H_2O_{(\ell)}$

(C) Double subscripts: use braces to clarify

(D) Double subscripts: use braces to clarify

77. What is the quantity of electricity required to produce 8 g of Mg (molar mass = $24 g\ mol^{-1}$) from $MgCl_2$ solution ?

(A) 0.222 F

(B) 0.444 F

(C) 0.666 F

(D) 0.888 F

78. What is the molar conductivity of 0.02 M KI solution if its conductivity is $4.37 \times 10^{-4}\ \Omega^{-1}\ cm^{-1}$?

(A) $8.74 \Omega^{-1}\ cm^2 mol^{-1}$

(B) $21.85 \Omega^{-1}\ cm^2 mol^{-1}$

(C) $43.70 \Omega^{-1}\ cm^2 mol^{-1}$

(D) $13.65 \Omega^{-1}\ cm^2 mol^{-1}$

79. Identify correct statement regarding order of reaction from following.

(A) Rate of zero order reaction depends on initial concentration of reactant.

(B) Decomposition of acetaldehyde is a first order reaction.

(C) Half life of first order reaction is independent of initial concentration of reactant.

(D) Half life of zero order reaction is independent of initial concentration of reactant

80. Calculate rate constant of a first order reaction having half life 1 minute 40 second?

(A) $1.76 \times 10^{-3} s^{-1}$

(B) $2.31 \times 10^{-3} s^{-1}$

(C) $6.93 \times 10^{-3} s^{-1}$

(D) $4.61 \times 10^{-3} s^{-1}$

81. In a reaction,

$2N_2O_{5(g)} \rightarrow 4\,NO_{2(g)} + O_{2(g)}$

N_2O_5 disappears at a rate of 0.06 mol dm^{-3} s^{-1}

Calculate rate of formation of $O_{2(g)}$?

(A) 0.02 mol dm^{-3} s^{-1}

(B) 0.03 mol dm^{-3} s^{-1}

(C) 0.04 mol dm^{-3} s^{-1}

(D) 0.06 mol dm^{-3} s^{-1}

82. Identify the term used to describe movement of colloidal particles under applied electric potential without using semipermeable membrane.

(A) Dialysis

(B) Electrophoresis

(C) Electroosmosis

(D) Brownian motion

83. Which element from following has highest melting point?

(A) Cr

(B) V

(C) Mn

(D) Fe

84. Identify the catalyst used in synthesis of gasoline by Fischer Tropsch process.

(A) Platinized asbestos

(B) Fe-Cr

(C) Co-Th

(D) MnO_2

85. Identify the formula of Bis(ethylenediamine)dithiocyanatoplatinum(IV)ion from following.

(A) $[Pt(en)_2(NCS)]^{2+}$

(B) $Pt[(en)_2(SCN)_2]^{4+}$

(C) $[Pt(en)_2(SCN)_2]^{2+}$

(D) $Pt[(en)_3(SCN)_2]^{4+}$

86. What is the coordination number of central metal ion in $[Co(en)_3]^{3+}$ complex ?

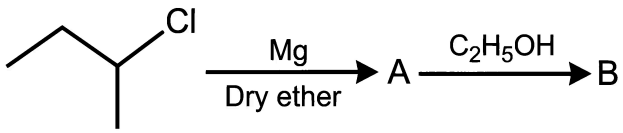
(A) 2

(B) 4

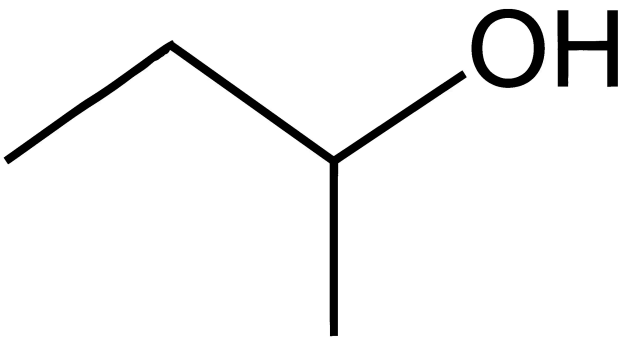
(C) 6

(D) 8

87. Identify the product 'B' in the following reaction sequence.



(A)



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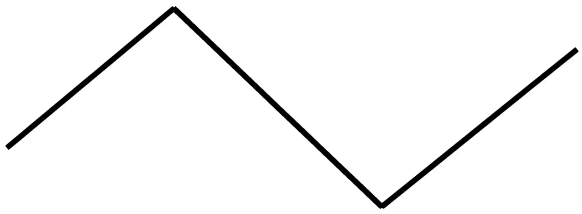

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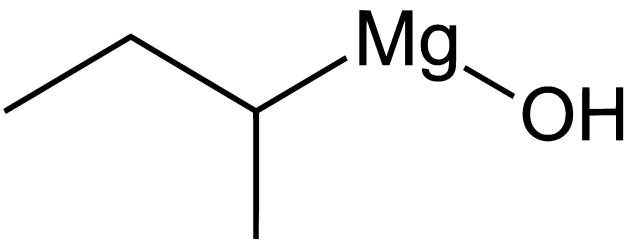

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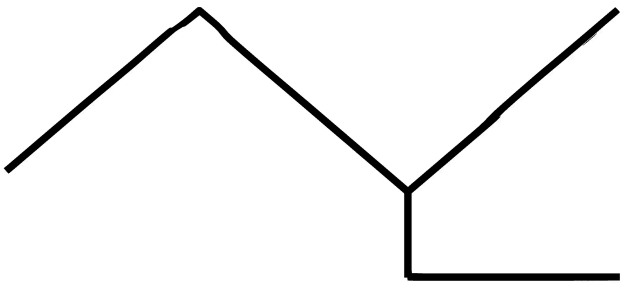

88. Which among the following is NOT a feature of SN^2 mechanism ?

(A) Single step mechanism

(B) Backside attack of nucleophile

(C) Formation of planar carbocation intermediate

(D) Involves simultaneous bond breaking and bond forming

89. Which reagent is used to convert Alkyl halide into Alkyl nitrite ?

(A) Silver nitrite

(B) Silver cyanide

(C) Potassium nitrite

(D) Silver carboxylate

90. Which of the following on reaction with Grignard's reagent followed by hydrolysis forms tertiary alcohol ?

(A) HCHO

(B) CH_3CHO

(C) CH_3-CH_2-CHO

(D) $CH_3 - CO - CH_3$

91. Identify product 'B' in following series of reactions

2-methylpropan-2-ol $\xrightarrow[363K]{20\%H_2SO_4}$ A $\xrightarrow[\text{Conc. } H_2SO_4]{H_2O\Delta}$ B

(A) n-Butylalcohol

(B) sec-Butylalcohol

(C) Iso-butylalcohol

(D) tert-Butylalcohol

92. Which among the following compounds has highest solubility in water?

(A) Phenol

(B) p-resol

(C) o-Nitrophenol

(D) p-Nitrophenol

93. Which of the following reaction represents Rosenmund reduction ?

(A) $R-CO-Cl \xrightarrow[Pd-BaSO_4]{H_2} R-CHO+HCl$

(B) $R-CN \xrightarrow[H_3O^+]{SnCl_2,HCl} R-CHO+NH_4Cl$

(C) $R-CHO \xrightarrow[\Delta]{Zn-Hg\ conc.HCl} R-CH_3+H_2O$

(D) $R-CO-R \xrightarrow[ii)\ KOH,\ HO-CH_2-CH_2-OH,\Delta]{i)\ H_2N-NH_2} R-CH_2-R$

94. Identify the substrate 'A' in the following reaction.

$A \xrightarrow[ii)\Delta]{i)\ Moist\ Ag_2O} CH_3CH_2N(CH_3)_2+CH_2=CH_2$

(A) Diethyldimethylammonium halide

(B) Ethyltrimethylammonium halide

(C) Diethyldimethylammonium hydroxide

(D) Ethyltrimethylammonium hydroxide

95. Which from following amino acids is an essential amino acid ?

(A) Phenylalanine

(B) Tyrosine

(C) Glutamine

(D) Alanine

96. Identify a natural source of ascorbic acid from following.

(A) Clove

(B) Wintergreen

(C) Citrus fruits

(D) Cinnamon

97. What type of glycosidic bond is present in maltose?

(A) β-1, 4

(B) α-1, 4

(C) α-1, 6

(D) β-2, 4

98. Which from following polymers is obtained by condensation polymerization method?

(A) Polythene

(B) Polyacrylonitrile

(C) Teflon

(D) Dacron

99. Which from following polymers is used to obtain shampoo bottles?

(A) HDPE

(B) LDPE

(C) PP

(D) PS

100. Identify the monomers used for preparation of glyptal?

(A) Styrene and phosgene

(B) Ethylene glycol and phthalic acid

(C) Butadiene and ethylene glycol

(D) Acrylamide and urea

Mathematics

Questions 101 to 150 | 2 marks each | 100 marks

101. If w is a complex cube root of unity , then the value of $w^{10} - w^7 + w^5 - w^2 + 1$ is.

(A) 0

(B) -1

(C) 1

(D) w

102. If $a_1, a_2, a_3, \ldots, a_n$ are in arithmetic progression with common difference d, then $tan[tan^{-1}(\frac{d}{1+a_1a_2}) + tan^{-1}(\frac{d}{1+a_2a_3}) + \ldots + tan^{-1}(\frac{d}{1+a_{n-1}a_n})]$ = _____

(A) $\frac{a_1-a_n}{1+a_1a_n}$

(B) $\frac{a_n-a_1}{1-a_1a_n}$

(C) $\frac{a_n-a_1}{1+a_1a_n}$

(D) $\frac{a_1+a_n}{1+a_1a_n}$

103. In a right-angled $\triangle ABC$, the measures of the angles are in an Arithmetic Progression (A.P.) If its smallest side is 4 units, then the area of $\triangle ABC$ is.....

(A) 16 sq. units

(B) $8\sqrt{3}$ sq. units

(C) $16\sqrt{3}$ sq. units

(D) 32 sq. units

104. If $sec^{-1}(\frac{x^2+y^2}{x^2-y^2}) = 2a$ such that $y\frac{dy}{dx} = x \cdot f(a)$ then the value of $f(\frac{2\pi}{3})$ is

(A) -3

(B) $\sqrt{3}$

(C) 3

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

105. The value of $cos15° - sin15°$ is .....

(A) $\sqrt{2}$

(B) $-\sqrt{2}$

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

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

106. The general solution of $cosx + sinx = cos2x + sin2x$ is $x = np\pi$ or $x = \frac{nq\pi}{3} + \frac{\pi}{6}$ for $n \in Z$ then $p : q =$

(A) $1 : 1$

(B) $1 : 2$

(C) $2 : 3$

(D) $2 : 1$

107. The number of common solutions of the pair of equations $2sin^2\theta - 2cos^2\theta + 1 = 0$ and $2sin^2\theta + 3sin\theta - 2 = 0$ in the interval $[0, 2\pi]$, is

(A) 1

(B) 2

(C) 3

(D) 4

108. The area of a triangle formed by a line with the coordinate axes is 49 sq. units. If the perpendicular drawn from the origin to this line makes an angle of 45° with the positive X-axis, then the equation of line is....

(A) $x + y = 7$

(B) $x + y = 7\sqrt{2}$

(C) $x + y = \sqrt{2}$

(D) $x + y = 2$

109. If the equation $16x^2 - 24xy + 9y^2 - 8x + 6y - 35 = 0$ represents a pair of straight lines, then the equation of the locus of points equidistant from these two lines is.....

(A) $4x - 3y - 1 = 0$

(B) $4x - 3y + 1 = 0$

(C) $8x - 6y - 1 = 0$

(D) $8x - 6y + 1 = 0$

110. The equation of the circle which passes through the points $(2, 3)$ and $(4, 5)$ and whose centre lies on a straight line $4x - y - 3 = 0$, is

(A) $(x-1)^2+(y-6)^2=10$

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

(C) $x^2+(y-7)^2=20$

(D) $(x-2)^2+(y-5)^2=4$

111. If θ is the eccentric angle of a point on the ellipse $\frac{x^2}{25}+\frac{y^2}{9}=1$ such that the distance of the point from the center is 5, then θ =.....

(A) 0

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

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

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

112. $\lim_{x\to 0}[\frac{x\cdot log(1+4x)}{(e^{4x}-1)^2}]=\cdots$

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

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

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

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

113. Consider the following statements.

p: If $3^4>4^3$, then $3^3>4^4$

q: The roots of the equation $x^2-2x+2=0$ are real if and only if Mumbai is in Maharashtra.

r: Statement p is true or statement q is false.

Which of the following has truth value T (true)?

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

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

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

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

114. Which of the following is/are not true ?

I) If 1 is not a prime number, then 2 is not a prime number.

II) e is a vowel and $12 \times 3 = 36$

III) It is not true that 14 is a composite number and 3 is even number.

IV) $\sqrt{5}$ is an irrational number, but $3 + \sqrt{5}$ is a complex number.

(A) Only I and IV

(B) Only I

(C) Only II and III

(D) Only I, II and IV

115. The negation of the inverse of the statement $\sim p \vee \sim q$ is...

(A) $p \wedge q$

(B) $\sim p \wedge q$

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

(D) $p \vee q$

116. If $A = \begin{bmatrix} 3 & 2 & 6 \\ 1 & 1 & 2 \\ 2 & 2 & 5 \end{bmatrix}, B = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$ such that $XA = B^T$ and $A^{-1}Y = B$, then $XY =$

(A) $[-1]$

(B) $[1]$

(C) $[-2]$

(D) $[2]$

117. Let $A = \begin{bmatrix} a & 1 \\ 1 & b \end{bmatrix}$, where a and b are the roots of the equation $x^2 - 4x + 2 = 0$. If $A + A^{-1} = kI_2$, then the value of k is _____

(A) 2

(B) $2\sqrt{2}$

(C) 4

(D) 1

118. The domain of the function $f(x) = \sqrt{x-1} + \sqrt{6-x}$ is...

(A) $[1, \infty)$

(B) $[1, 6]$

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

(D) $(6, \infty)$

119. The domain of the function $f(x) = {}^{(10-x)}C_{(x-6)}$ is...

(A) $[6, 10]$

(B) $\{6, 7, 8, 9, 10\}$

(C) $[6, 8]$

(D) $\{6, 7, 8\}$

120. Let $[x]$ denotes the greatest integer less than or equal to x and $f(x) = [tan^2 x]$, then which of the following is true ?

(A) $\lim_{x \to 0} f(x)$ does not exist

(B) $f(x)$ is continuous at $x = 0$

(C) $f(x)$ is not differentiable at $x = 0$

(D) Missing open brace for superscript

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121. If $\sqrt{y+x} + \sqrt{y-x} = c$ and $\frac{dy}{dx} = K - \sqrt{\frac{y^2}{x^2} - 1}$, then the value of K is

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

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

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

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

---

122. If $y = (x^2 + 1)^{sinx}$ for $x > 0$ such that $\frac{dy}{dx} = y[\frac{2xsinx}{g(x)} + cosx \cdot log[g(x)]]$, then the function $\frac{1}{g(x)}$ is...

(A) increasing

(B) strictly increasing.

(C) decreasing

(D) strictly decreasing

---

123. The derivative of $f(sinx)$ with respect to $g(secx)$ at $x = \frac{\pi}{4}$, given that Missing open brace for superscript and Missing open brace for superscript is.....

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

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

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

(D) $\frac{-1}{3}$

124. A spherical iron ball 10 cm in radius is coated with a layer of ice of uniform thickness that melts at a rate of $50\text{cm}^3/\text{min}$. When the thickness of ice is 5 cm, the rate at which the thickness of ice decreases is...

(A) $\frac{1}{18\pi}\text{cm/min}$

(B) $\frac{1}{36\pi}\text{cm/min}$

(C) $\frac{5}{6\pi}\text{cm/min}$

(D) $\frac{1}{54\pi}\text{cm/min}$

125. If the line $ax + by + 5 = 0$ is a normal to the curve $xy = 1$ then .....

(A) $a > 0, b < 0$

(B) $a < 0, b < 0$

(C) $a > 0, b = 0$

(D) $a > 0, b > 0$

126. On the interval $[0, 1]$, the function $f(x) = x^{25}(1 - x)^{75}$ attains its maximum value at the point $x =$....

(A) 0

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

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

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

127. If $f(x) = \int \frac{x}{(x^2+4)(x^2+9)}\,dx$ and $f(0) = \frac{1}{5}log(\frac{2}{3})$, then $f(1) =$

(A) $\frac{1}{5}log(2)$

(B) $\frac{1}{10}log(2)$

(C) $-\frac{1}{5}log(2)$

(D) $-\frac{1}{10}log(2)$

128. $\int \frac{x^4(x^{10}-1)}{x^{20}+3x^{10}+1}\,dx = \cdots$

(A) $tan^{-1}(x^5 + \frac{1}{x^5}) + c$

(B) $\frac{1}{5}tan^{-1}(x^5 + \frac{1}{x^5}) + c$

(C) $tan^{-1}(x^{10} + \frac{1}{x^{10}}) + c$

(D) $\frac{1}{10}tan^{-1}(x^{10} + \frac{1}{x^{10}}) + c$

129. $\int (e^{log(sinx)} + cosx)x\,dx =$

(A) $x(sinx + cosx) + (sinx - cosx) + c$

(B) $x(sinx - cosx) + (sinx - cosx) + c$

(C) $x(sinx + cosx) + (sinx + cosx) + c$

(D) $x(sinx - cosx) + (sinx + cosx) + c$

130. The value of $\int sin4xcos3x\,dx$ is

(A) $-\frac{1}{14}cos7x-\frac{1}{2}cosx+c$

(B) $-\frac{1}{14}cos7x+\frac{1}{2}cosx+c$

(C) $\frac{1}{14}cos7x-\frac{1}{2}cosx+c$

(D) $\frac{1}{14}cos7x+\frac{1}{2}cosx+c$

131. If $[x]$ denotes the greatest integer less than or equal to x, then the value of the integral $\int_0^2 x^2[x]\,dx$ is equal to

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

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

(C) $\frac{7}{3}$

(D) 0

132. If $\int_0^1 \frac{dx}{\sqrt{x+1}-\sqrt{x}}=\sqrt{2}k$, then the value of k is...

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

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

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

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

133. The area of the region lying in the first quadrant and bounded by the curve $y=4x^2$, the Y-axis, and the lines $y=2$, $y=4$ is...

(A) $\frac{1}{3}[8+2\sqrt{2}]$ sq. units

(B) $\frac{1}{3}[8-2\sqrt{2}]$ sq. units

(C) $\frac{1}{2}[8-2\sqrt{2}]$ sq. units

(D) $\frac{1}{2}[8+2\sqrt{2}]$ sq. units

134. The area bounded by the curves $y=|x|-1$ and $y=-|x|+1$ is

(A) 1 sq.unit

(B) 2 sq. units

(C) $2\sqrt{2}$ sq.units

(D) 4 sq.units

135. If $y=f(x)$ is a monotonically increasing function such that $(\frac{dy}{dx})^2=6-\frac{dy}{dx}$ and $y(0)=5$, then $y(3)=\cdots$

(A) 23

(B) 14

(C) 13

(D) 11

136. If $tanx$ is an integrating factor of the differential equation $\frac{dy}{dx}+Py=Q$, then P can be

(A) $2sec2x$

(B) $tan2x$

(C) $sin2x$

(D) $2csc2x$

137. The order and degree of the differential equation $(\frac{d^3y}{dx^3})^{\frac{2}{3}} - 3\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 4 = 0$ are respectively

(A) $2, 3$

(B) $3, 2$

(C) 3, not defined

(D) not defined, 3

138. Let $\bar{a} = \hat{i} + \hat{j} + \hat{k}$, $\bar{b} = \hat{i} - 3\hat{j} + 2\hat{k}$ and $\bar{c} = 3\hat{i} - 2\hat{k}$. If a vector $\bar{p}$ satisfies the conditions $\bar{p} \cdot \bar{c} = 0$ and $\bar{p} \times \bar{a} = \bar{b} \times \bar{a}$, then the value of $|\bar{p}|$ =...

(A) $\sqrt{13}$

(B) $\sqrt{14}$

(C) $\sqrt{17}$

(D) $\sqrt{19}$

139. The volume of the tetrahedron whose vertices are A$(-1, 2, 3)$, B $(3, -2, 1)$, C$(p, 1, 3)$, D$(-1, -2, 4)$ is $\frac{16}{3}$ cubic units then the value of p is

(A) $\frac{-10}{3}$

(B) 5

(C) 8

(D) 10

140. Let $\overline{OD} = \hat{i} + 2\hat{j} + 6\hat{k}$, $\overline{CB} = -3\hat{i} - 2\hat{k}$ be the diagonals of the parallelogram OBDC and $\overline{OA} = \hat{i} + 2\hat{j} + 3\hat{k}$ be another vector. Then the volume of a parallelopiped determined by vectors $\overline{OA}$, $\overline{OB}$, and $\overline{OC}$ (in cubic units), is

(A) 3

(B) 6

(C) 9

(D) 12

141. If $\bar{a}$ and $\bar{b}$ are unit vectors perpendicular to each other, then $[\bar{a} + (\bar{a} \times \bar{b})\,\bar{b} + (\bar{a} \times \bar{b})\,(\bar{a} \times \bar{b})] = \cdots$

(A) -1

(B) 1

(C) 2

(D) 3

142. If $\bar{a}$, $\bar{b}$ and $\bar{c}$ are three vectors such that $|\bar{a} + \bar{b} + \bar{c}| = 1$, $\bar{c} = \lambda(\bar{a} \times \bar{b})$ and $|\bar{a}| = \frac{1}{\sqrt{3}}$, $|\bar{b}| = \frac{1}{\sqrt{2}}$, $|\bar{c}| = \frac{1}{\sqrt{6}}$, then the angle between $\bar{a}$ and $\bar{b}$ is

(A) $\frac{\pi^c}{6}$

(B) $\frac{\pi^c}{4}$

(C) $\frac{\pi^c}{3}$

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

143. The acute angle between the line $\vec{r} = (\hat{i} + 2\hat{j} + \hat{k}) + \lambda(\hat{i} + \hat{j} + \hat{k})$ and the plane $\vec{r} \cdot (2\hat{i} + p\hat{j} + \hat{k}) = 8$ is $sin^{-1}(\frac{\sqrt{2}}{3})$, then the value of p are...

(A) $p = 1$ or $p = 17$

(B) $p = -1$ or $p = -17$

(C) $p = 6$ or $p = 3$

(D) $p = -6$ or $p = -3$

144. 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) $5\sqrt{30}$

(B) $3\sqrt{30}$

(C) $2\sqrt{30}$

(D) $\sqrt{30}$

145. A plane meets the co-ordinate axes in A, B, C such that the centroid of the triangle ABC is the point $(1, r, r^2)$, then the equation of the plane is,

(A) $x + ry + r^2z = 3r^2$

(B) $r^2x + ry + z = 3r^2$

(C) $x + ry + r^2z = 3$

(D) $r^2x + ry + z = 3$

146. If M denotes the midpoint of the line joining A$(4, 5, -10)$ and B $(-1, 2, 1)$, then the equation of the plane through M and perpendicular to AB is:

(A) $\bar{r} \cdot (-5\hat{i} - 3\hat{j} + 11\hat{k}) + \frac{135}{2} = 0$

(B) $\bar{r} \cdot (\frac{3}{2}\hat{i} + \frac{7}{2}\hat{j} - \frac{9}{2}\hat{k}) + \frac{135}{2} = 0$

(C) $\bar{r} \cdot (4\hat{i} + 5\hat{j} - 10\hat{k}) + 4 = 0$

(D) $\bar{r} \cdot (-\hat{i} + 2\hat{j} + \hat{k}) + 4 = 0$

147. The difference between the maximum value and the minimum value of the objective function $z = 3x + y$ subject to the constraints $2x + 3y \leq 6$, $x + y \geq 1$, $x \geq 0$, $y \geq 0$ is....

(A) 7

(B) 3

(C) 8

(D) 1

148. A random variable $X \sim B(n, p)$ follows a binomial distribution with $n = 6$. If $9P(X = 4) = P(X = 2)$, then the probability of success p is..

(A) 0.125

(B) 0.75

(C) 0.25

(D) 0.375

149. Let X be a continuous random variable with the probability density function(p.d.f.) given by

$$f(x) = \begin{cases} kx, & 0 \le x < 1 \\ k, & 1 \le x < 2 \\ -kx + 3k, & 2 \le x < 3 \\ 0, & \text{otherwise} \end{cases}$$

$P(2 < X \le 3) = \cdots$

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

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

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

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

150. In a certain city, the ratio of men to women is 5 : 4. It is found that 80% of men and 90% of women are literate. If a person selected at random is found to be illiterate, then the probability that the person is a man is....

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

(B) $\frac{5}{7}$

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

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