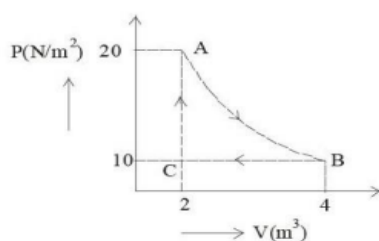


MHT CET 2024 Mathematics Memory Based Question Paper PDF

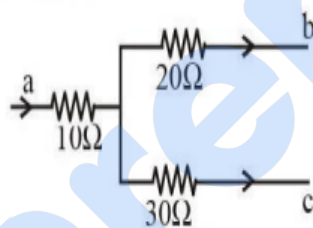
PHYSICS

- Force between two point charges q_1 and q_2 placed in vacuum at 'r' cm apart is F. Force between them when placed in a medium having dielectric $K = 5$ at 'r/5' cm apart will be:
 - F/25
 - 5F
 - F/5
 - 25F
- A thin circular disc of mass M and radius R is rotating in a horizontal plane about an axis passing through its centre and perpendicular to its plane with angular velocity ω . If another disc of same dimensions but of mass $M/2$ is placed gently on the first disc co-axially, then the new angular velocity of the system is :
 - $\frac{4}{5}\omega$
 - $\frac{5}{4}\omega$
 - $\frac{2}{3}\omega$
 - $\frac{3}{2}\omega$
- Correct Bernoulli's equation is (symbols have their usual meaning) :
 - $P + mgh + \frac{1}{2}mv^2 = \text{constant}$
 - $P + \rho gh + \frac{1}{2}\rho v^2 = \text{constant}$
 - $P + \rho gh + \rho v^2 = \text{constant}$
 - $P + \frac{1}{2}\rho gh + \frac{1}{2}\rho v^2 = \text{constant}$
- Two projectiles are projected at 30° and 60° with the horizontal with the same speed. The ratio of the maximum height attained by the two projectiles respectively is:
 - $2 : \sqrt{3}$
 - $\sqrt{3} : 1$
 - $1 : 3$
 - $1 : \sqrt{3}$
- A real gas within a closed chamber at 27°C undergoes the cyclic process as shown in figure. The gas obeys $PV^3 = RT$ equation for the path A to B. The net work done in the complete cycle is (assuming $R = 8\text{J/molK}$):



- 225 J
- 205 J

- (c) 20 J
(d) -20 J
6. Light emerges out of a convex lens when a source of light kept at its focus. The shape of wavefront of the light is:
- (a) Both spherical and cylindrical
(b) Cylindrical
(c) Spherical
(d) Plane
7. A monkey of mass 50 kg climbs on a rope which can withstand the tension (T) of 350 N. If monkey initially climbs down with an acceleration of $4m/s^2$ and then climbs up with an acceleration of $5m/s^2$. Choose the correct option ($g = 10m/s^2$).
- (a) T = 700 N while climbing upward
(b) T = 350 N while going downward
(c) Rope will break while climbing upward
(d) Rope will break while going downward
8. Figure shows a part of an electric circuit. The potentials at points a, b and c are 30 V, 12 V and 2 V respectively. The current through the 20Ω resistor will be.



- (a) 0.4 A
(b) 0.2 A
(c) 0.6 A
(d) 1.0 A
9. A current of $200\mu A$ deflects the coil of a moving coil galvanometer through 60° . The current to cause deflection through $\frac{\pi}{10}$ radian is :
- (a) $30\mu A$
(b) $120\mu A$
(c) $60\mu A$
(d) $180\mu A$
10. The value of acceleration due to gravity at Earth's surface is $9.8ms^{-2}$. The altitude above its surface at which the acceleration due to gravity decreases to $4.9ms^{-2}$, is close to : (Radius of earth = 6.4×10^6m)
- (a) 2.6×10^6m
(b) 6.4×10^6m
(c) 9.0×10^6m
(d) 1.6×10^6m
11. Relative permittivity and permeability of a material ϵ_r and μ_r respectively. Which of the following values of these quantities are allowed for a diamagnetic material?

- (a) $\epsilon_r = 0.5, \mu_r = 1.5$
(b) $\epsilon_r = 1.5, \mu_r = 0.5$
(c) $\epsilon_r = 0.5, \mu_r = 0.5$
(d) $\epsilon_r = 1.5, \mu_r = 1.5$
12. The magnetic flux through a coil perpendicular to its plane is varying according to the relation $\phi = (5t^3 + 4t^2 + 2t - 5)$ Weber. If the resistance of the coil is 5 ohm, then the induced current through the coil at $t = 2$ sec will be:
(a) 15.6 A
(b) 16.6 A
(c) 17.6 A
(d) 18.6 A
13. A solid metallic cube having total surface area $24m^2$ is uniformly heated. If its temperature is increased by $10^\circ C$, calculate the increase in volume of the cube. (Given : $\alpha = 5.0 \times 10^{-4} C^{-1}$)
(a) $2.4 \times 10^6 cm^3$
(b) $1.2 \times 10^5 cm^3$
(c) $6.0 \times 10^4 cm^3$
(d) $4.8 \times 10^5 cm^3$
14. Two coils are placed close to each other. The mutual inductance of the pair of coils depends upon
(a) the rates at which currents are changing in the two coils
(b) relative position and orientation of the two coils
(c) the materials of the wires of the coils
(d) the currents in the two coils
15. A proton, an electron and an alpha particle have the same energies. Their de-Broglie wavelengths will be compared as:
(a) $\lambda_e > \lambda_p > \lambda_\alpha$
(b) $\lambda_\alpha < \lambda_p < \lambda_e$
(c) $\lambda_p < \lambda_e < \lambda_\alpha$
(d) $\lambda_p > \lambda_e > \lambda_\alpha$
16. An ice cube has a bubble inside. When viewed from one side the apparent distance of the bubble is 12 cm. When viewed from the opposite side, the apparent distance of the bubble is observed as 4 cm. If the side of the ice cube is 24 cm, the refractive index of the ice cube is
(a) $\frac{4}{3}$
(b) $\frac{3}{2}$
(c) $\frac{2}{3}$
(d) $\frac{6}{5}$
17. The longest wavelength associated with Paschen series is : (Given $R_H = 1.097 \times 10^7$ SI unit)
(a) $1.094 \times 10^{-6} m$
(b) $2.973 \times 10^{-6} m$
(c) $3.646 \times 10^{-6} m$
(d) $1.876 \times 10^{-6} m$

18. The ratio of the mass densities of nuclei of ^{40}Ca and ^{16}O is close to :
- (a) 1
 - (b) 0.1
 - (c) 5
 - (d) 2
19. Point charge of $10\mu\text{C}$ is placed at the origin. At what location on the X-axis should a point charge of $40\mu\text{C}$ be placed so that the net electric field is zero at $x = 2$ cm on the X-axis?
- (a) $x = 6$ cm
 - (b) $x = 4$ cm
 - (c) $x = 8$ cm
 - (d) $x = -4$ cm
20. A magnetic needle is kept in a non-uniform magnetic field. It experiences
- (a) neither a force nor a torque
 - (b) a torque but not a force
 - (c) a force but not a torque
 - (d) a force and a torque

A current carrying rectangular loop PQRS is made of uniform wire. The length $\text{PR} = \text{QS} = 5$ cm and $\text{PQ} = \text{RS} = 100$ cm. If ammeter current reading changes from I to $2I$, the ratio of magnetic forces per unit length on the wire PQ due to wire RS in the two cases respectively $f_{PQ}^1 : f_{PQ}^{21}$ is:

- 1. 1 : 2
- 2. 1 : 4
- 3. 1 : 5
- 4. 1 : 3

At which temperature the r.m.s. velocity of a hydrogen molecule equal to that of an oxygen molecule at 47°C ?

- 1. 80 K
- 2. 4 K
- 3. -73 K
- 4. 20 K

A light emitting diode (LED) is fabricated using GaAs semiconducting material whose band gap is 1.42 eV. The wavelength of light emitted from the LED is:

- 1. 650 nm
- 2. 875 nm
- 3. 1243 nm
- 4. 1400 nm

A steel wire with mass per unit length $7.0 \times 10^{-3} \text{ kg m}^{-1}$ is under tension of 70N. The speed of transverse waves in the wire will be:

1. 100 m/s
2. 10 m/s
3. 50 m/s
4. $200 \pi \text{ m/s}$

Two vessels A and B are of the same size and are at same temperature. A contains 1g of hydrogen and B contains 1g of oxygen. P_A and P_B are the pressures of the gases in A and B respectively, then $\frac{P_A}{P_B}$ is:

1. 8
2. 16
3. 32
4. 4

A wire of length 1 m moving with velocity 8 m/s at right angles to a magnetic field of 2T. The magnitude of induced emf, between the ends of wire will be

1. 20V
2. 8V
3. 12V
4. 16V

Two identical particles each of mass 'm' go round a circle of radius a under the action of their mutual gravitational attraction. The angular speed of each particle will be:

1. $\sqrt{\frac{Gm}{2a^3}}$
2. $\sqrt{\frac{Gm}{4a^3}}$
3. $\sqrt{\frac{Gm}{8a^3}}$
4. $\sqrt{\frac{Gm}{a^3}}$

In an unbiased n-p junction electrons diffuse from n-region to p-region because :

1. holes in p-region attract them
2. electrons travel across the junction due to potential difference
3. only electrons move from n to p region and not the vice-versa
4. electron concentration in n-region is more compared to that in p-region

A particle is executing Simple Harmonic Motion (SHM). The ratio of potential energy and kinetic energy of the particle when its displacement is half of its amplitude will be:

1. 1 : 1
2. 1 : 4
3. 2 : 1

4. 1 : 3

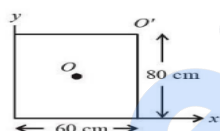
Eight equal drops of water are falling through air with a steady speed of 10 cm/s. If the drops coalesce, the new velocity is:

1. 10 cm/s
2. 16 cm/s
3. 40 cm/s
4. 5 cm/s

In a coil, the current changes from -2 A to $+2$ A in 0.2 s and induces an emf of 0.1 V. The self-inductance of the coil is :

1. 5mH
2. 2.5mH
3. 1mH
4. 4mH

For a uniform rectangular sheet shown in the figure, the ratio of moments of inertia about the axes perpendicular to the sheet and passing through O (the centre of mass) and O' (corner point) is :



1. $2/3$
2. $1/8$
3. $1/4$
4. $1/2$

If n is the number density and d is the diameter of the molecule, then the average distance covered by a molecule between two successive collisions (i.e. mean free path) is represented by:

1. $\frac{1}{\sqrt{2}n\pi d^2}$
2. $\frac{1}{\sqrt{2}\pi d^2}$
3. $\frac{1}{\sqrt{2}n\pi d}$
4. $\frac{1}{\sqrt{2}n^2\pi^2 d^2}$

A mixture of one mole of monoatomic gas and one mole of a diatomic gas (rigid) are kept at room temperature (27°C). The ratio of specific heat of gases at constant volume respectively is:

1. $\frac{7}{5}$
2. $\frac{3}{2}$
3. $\frac{3}{5}$
4. $\frac{5}{3}$

In an a.c. circuit, voltage and current are given by :

$$V = 100 \sin(100t) V \text{ and}$$

$$I = 100 \sin(100t + \frac{\pi}{3}) mA \text{ respectively.}$$

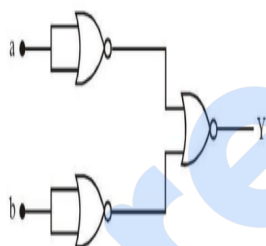
The average power dissipated in one cycle is:

1. 10 W
2. 2.5 W
3. 25 W
4. 5 W

The difference between threshold wavelengths for two metal surfaces A and B having work function $\phi_A = 9 \text{ eV}$ and $\phi_B = 4.5 \text{ eV}$ in nm is: (Given, $hc = 1242 \text{ eV nm}$)

1. 264
2. 138
3. 276
4. 540

The logic performed by the circuit shown in figure is equivalent to:



1. AND
2. OR
3. NAND
4. NOR

A particle performs simple harmonic motion with amplitude A . Its speed is tripled at the instant that it is at a distance $\frac{2A}{3}$ from equilibrium position. The new amplitude of the motion is :

1. $A\sqrt{3}$
2. $\frac{A}{3}\sqrt{41}$
3. $\frac{7A}{3}$
4. $3A$

The mass of proton, neutron and helium nucleus are respectively 1.0073 u, 1.0087 u and 4.0015 u. The binding energy of helium nucleus is:

1. 14.2 MeV
2. 28.4 MeV
3. 56.8 MeV
4. 7.1 MeV

A series LCR circuit is subjected to an AC signal of 200 V, 50 Hz. If the voltage across the inductor ($L = 10 \text{ mH}$) is 31.4 V, then the current in this circuit is

1. 68 A
2. 63 A
3. 10 A
4. 10 mA

When two soap bubbles of radii a and b ($b > a$) coalesce, the radius of curvature of common surface is

1. $\frac{ab}{b-a}$
2. $\frac{ab}{a+b}$
3. $\frac{b-a}{ab}$
4. $\frac{a+b}{ab}$

A liquid is allowed to flow into a tube of truncated cone shape. Identify the correct statement from the following:

1. the speed is high at the wider end and high at the narrow end.
2. the speed is low at the wider end and high at the narrow end.
3. the speed is same at both ends in a stream line flow.
4. the liquid flows with uniform velocity in the tube.

The velocity of sound in a gas in which two wavelengths 4.08m and 4.16m produce 40 beats in 12s, will be :

1. 2.828 ms^{-1}
2. 353.6 ms^{-1}
3. 175.5 ms^{-1}
4. 707.2 ms^{-1}

σ is the uniform surface charge density of a thin spherical shell of radius R . The electric field at any point on the surface of the spherical shell is:

1. $\frac{\sigma}{\epsilon_0} R$
2. $\frac{\sigma}{2\epsilon_0}$
3. $\frac{\sigma}{\epsilon_0}$
4. $\frac{\sigma}{4\epsilon_0}$

An electric field is given by $(6\hat{i} + 5\hat{j} + 3\hat{k}) \text{ N/C}$. The electric flux through a surface area $30\hat{i} \text{ m}^2$ lying in YZ-plane (in SI unit) is ;

1. 180
2. 100 times
3. 90
4. 10 times

A big drop is formed by coalescing 1000 small droplets of water. The surface energy will become:

1. $\frac{1}{100}$ th
2. 100 times
3. $\frac{1}{10}$ th
4. 10 times

If 'M' is the mass of water that rises in a capillary tube of radius 'r', then mass of water which will rise in a capillary tube of radius '2r' is :

1. M
2. M/2
3. 4 M
4. 2 M

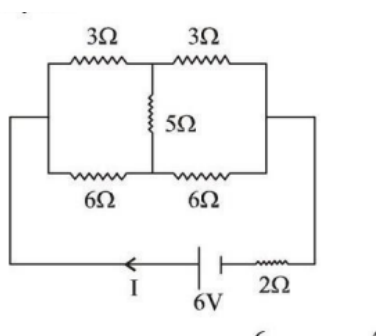
A closed organ pipe (closed at one end) is excited to support the third overtone. It is found that air in the pipe has

1. three nodes and three antinodes
2. three nodes and four antinodes
3. four nodes and three antinodes
4. four nodes and four antinodes

The electrostatic potential due to an electric dipole at a distance 'r' varies as:

1. r
2. $1/r^2$
3. $1/r^3$
4. $1/r$

A battery of 6 V is connected to the circuit as shown below. The current I drawn from the battery is :



1. 1A
2. 2A
3. $\frac{6}{11}A$
4. $\frac{4}{3}A$

CHEMISTRY

51. If the length of the body diagonal of a FCC unit cell is $x\text{\AA}$, the distance between two octahedral voids in the cell in $\text{\AA}$ is :
- (a) $x/\sqrt{2}$
(b) $x/\sqrt{3}$
(c) $x/\sqrt{6}$
(d) $x/\sqrt{8}$
52. Ortho-sulphobenzimide is used as
- (a) Anti oxidant
(b) Artificial sweetener
(c) Food Preservative
(d) Food supplement
53. Volume of a gas at NTP is $1.12 \times 10^{-7} \text{cm}^3$. The number of molecules in it is :
- (a) 3.01×10^{12}
(b) 3.01×10^{24}
(c) 3.01×10^{23}
(d) 3.01×10^{20}
54. The wavelength of the radiation emitted, when in a hydrogen atom electron falls from infinity to stationary state 1, would be (Rydberg constant = $1.097 \times 10^7 \text{m}^{-1}$)
- (a) 406 nm
(b) 192 nm
(c) 91 nm
(d) $9.1 \times 10^{-8} \text{nm}$
55. In NO_3^- ion, the number of bond pairs and lone pairs of electrons on nitrogen atom are
- (a) 2, 2
(b) 3, 1
(c) 1, 3
(d) 4, 0
56. In which of the compounds does 'manganese' exhibit highest oxidation number ?

- (a) MnO_2
- (b) Mn_3O_4
- (c) K_2MnO_4
- (d) $MnSO_4$

57. Alkali metals are powerful reducing agents because

- (a) they are metals
- (b) they are monovalent
- (c) their ionic radii are large
- (d) their ionisation energies are low

58. A balloon filled with an air sample occupies 3 L volume at 35°C . On lowering the temperature to T, the volume decreases to 2.5 L. The temperature T is?
[Assume p-constant]

- (a) 16°C
- (b) -16°C
- (c) 24°C
- (d) -20°C

59. Which one of the following is used as an eye lotion?

- (a) Milk of magnesia
- (b) Silver sol
- (c) Colloidal antimony
- (d) Chromium salt sol

60. Identify ortho and para directing groups from the following :
 $-CHO$, $-NHCOCH_3$, $-OCH_3$, $-SO_3H$

I, II, III, IV

- (a) III, IV
- (b) II, III
- (c) II, IV
- (d) I, IV

61. Which one of the carbanions is the least stable?

- (a) $CH_2 - NO_2$

- (b) $CH_2 - CHO$
- (c) $CH_2 - CH_3$
- (d) CH_3
62. In O_2^- , O_2 and O_2^{2-} molecular species, the total number of antibonding electrons respectively are
- (a) 7, 6, 8
- (b) 1, 0, 2
- (c) 6, 6, 6
- (d) 8, 6, 8
63. People living at high altitudes often reported with a problem of feeling weak and inability to think clearly. The reason for this is.
- (a) at high altitudes the partial pressure of oxygen is less than at the ground level.
- (b) at high altitudes the partial pressure of oxygen is more than at the ground level.
- (c) at high altitudes the partial pressure of oxygen is equal to at the ground level.
- (d) None of these.
64. Specific conductance of 0.1 M HNO_3 is $6.3 \times 10^{-2} ohm^{-1}cm^{-1}$. The molar conductance of the solution is
- (a) $100 ohm^{-1}cm^2$
- (b) $515 ohm^{-1}cm^2$
- (c) $630 ohm^{-1}cm^2$
- (d) $6300 ohm^{-1}cm^2$
65. The rate constant for a first order reaction whose half-life, is 480 seconds is :
- (a) $2.88 \times 10^{-3} sec^{-1}$
- (b) $2.72 \times 10^{-3} sec^{-1}$
- (c) $1.44 \times 10^{-3} sec^{-1}$
- (d) $1.44 sec^{-1}$
66. If the activation energy for the forward reaction is $150 kJ mol^{-1}$ and that of the reverse reaction is $260 kJ mol^{-1}$, what is the enthalpy change for the reaction ?
- (a) $410 kJ mol^{-1}$
- (b) $-110 kJ mol^{-1}$
- (c) $110 kJ mol^{-1}$
- (d) $-410 kJ mol^{-1}$
67. For As_2S_3 sol, the most effective coagulating agent is

- (a) $CaCO_3$
- (b) $NaCl$
- (c) $FeCl_3$
- (d) Clay

68. Element not showing variable oxidation state is:

- (a) Bromine
- (b) Iodine
- (c) Chlorine
- (d) Fluorine

69. Which of the following arrangements does not represent the correct order of the property stated against it ?

- (a) $V^{2+} < Cr^{2+} < Mn^{2+} < Fe^{2+}$: paramagnetic behaviour
- (b) $Ni^{2+} < Co^{2+} < Fe^{2+} < Mn^{2+}$: ionic size
- (c) $Co^{3+} < Fe^{3+} < Cr^{3+} < Sc^{3+}$: stability in aqueous solution
- (d) $Sc < Ti < Cr < Mn$: number of oxidation states

70. The IUPAC name for the complex $[Co(ONO)(NH_3)_5]Cl_2$ is

- (a) pentaamminenitrito-O-cobalt(II) chloride
- (b) pentaamminenitrito-O-cobalt(III) chloride
- (c) nitrito-N-pentaamminecobalt(III) chloride
- (d) nitrito-N-pentaamminecobalt(II) chloride

71. Which of the following compounds will give racemic mixture on nucleophilic substitution by OH^- ion?

- (a) (i)
- (b) (i), (ii) and (iii)
- (c) (ii) and (iii)
- (d) (i) and (iii)

72. Which one of the following is not correct for an ideal solution?

- (a) It must obey Raoult's law
- (b) $\Delta H = 0$
- (c) $\Delta H = \Delta V \neq 0$

(d) All are correct

73. For a relation $\Delta_r G = -nFE_{\text{cell}}$, $E_{\text{cell}} = E_{\text{cell}}^\circ$ in which of the following condition?

- (a) Concentration of any one of the reacting species should be unity
- (b) Concentration of all the product species should be unity.
- (c) Concentration of all the reacting species should be unity.
- (d) Concentration of all reacting and product species should be unity.

74. Which one of the lanthanoids given below is the most stable in divalent form?

- (a) Ce (Atomic Number 58)
- (b) Sm (Atomic Number 62)
- (c) Eu (Atomic Number 63)
- (d) Yb (Atomic Number 70)

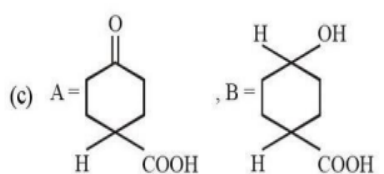
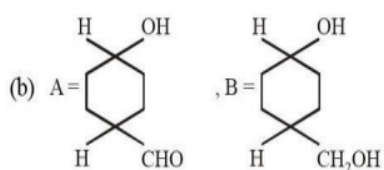
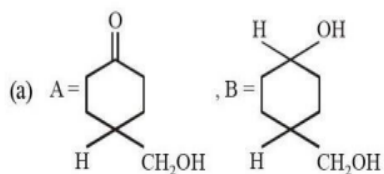
75. The value of the 'spin only' magnetic moment for one of the following configurations is 2.84 BM. The correct one is

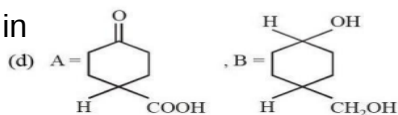
- (a) d^5 (in strong ligand field)
- (b) d^3 (in weak as well as in strong fields)
- (c) d^4 (in weak ligand fields)
- (d) d^4 (in strong ligand fields)

76. Chlorobenzene reacts with Mg in dry ether to give a compound (A) which further reacts with ethanol to yield

- (a) Phenol
- (b) Benzene
- (c) Ethylbenzene
- (d) Phenyl ether

77. The products formed in the following reaction, A and B are





78. Which of the following represents the correct order of the acidity in the given compounds?

- (a) $FCH_2COOH > CH_3COOH > BrCH_2COOH > ClCH_2COOH$
- (b) $BrCH_2COOH > ClCH_2COOH > FCH_2COOH > CH_3COOH$
- (c) $FCH_2COOH > ClCH_2COOH > BrCH_2COOH > CH_3COOH$
- (d) $CH_3COOH > BrCH_2COOH > ClCH_2COOH > FCH_2COOH$

79. Ethyl alcohol can be prepared from Grignard reagent by the reaction of :

- (a) $HCHO$
- (b) R_2CO
- (c) RCN
- (d) $RCOCl$

80. Which of the following is most acidic?

- (a) Benzyl alcohol
- (b) Cyclohexanol
- (c) Phenol
- (d) m-chlorophenol

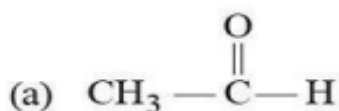
81. Nitration of the compound is carried out, this compound gives red-orange ppt. with 2,4-DNP, this compound undergoes Cannizzaro reaction but not aldol, then possible product due to nitration is

- (a) 3-nitroacetophenone
- (b) (2-nitro)-2-phenylethanal
- (c) (2-nitro)-1-phenylpropan-2-one
- (d) 3-nitrobenzaldehyde

82. Which of the following reactions will not give a primary amine?

- (a) $CH_3CONH_2 \xrightarrow{Br_2/KOH}$
- (b) $CH_3CN \xrightarrow{LiAlH_4}$
- (c) $CH_3NC \xrightarrow{LiAlH_4}$
- (d) $CH_3CONH_2 \xrightarrow{LiAlH_4}$

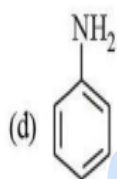
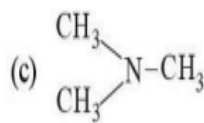
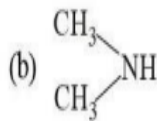
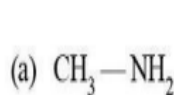
83. Which of the following compounds is most reactive towards nucleophilic addition reactions?



84. Molecules whose mirror image is non-superimposable over them are known as chiral. Which of the following molecules is chiral in nature?

- (a) 2 - bromobutane
- (b) 1 - bromobutane
- (c) 2 - bromopropane
- (d) 2 - bromopropan - 2 - ol

85. The most reactive amine towards dilute hydrochloric acid is



86. One of essential α -amino acids is

- (a) lysine
- (b) serine
- (c) glycine
- (d) proline

87. Which of the following statements is true about a peptide bond (RCONHR)?

- (a) It is non planar.
- (b) It is capable of forming a hydrogen bond.
- (c) The cis configuration is favoured over the trans configuration.
- (d) Single bond rotation is permitted between nitrogen and the carbonyl group.

88. Which of the following is an example for chain-growth polymer?

- (a) Bakelite
- (b) Teflon
- (c) Nylon

(d) Terylene

89. Which of the following polymer is formed due to the co-polymerisation of 1,3-butadiene and phenylethene?

- (a) Buna-N
- (b) Neoprene
- (c) Novalac
- (d) Buna-S

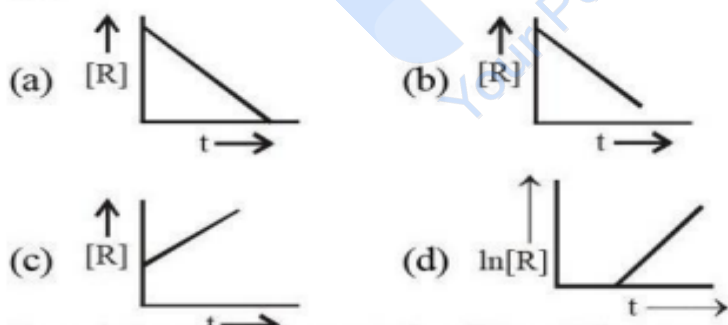
90. For 1 molal aqueous solution of the following compounds, which one will show the highest freezing point?

- (a) $[Co(H_2O)_6]Cl_3$
- (b) $[Co(H_2O)_5Cl]Cl_2 \cdot H_2O$
- (c) $[Co(H_2O)_4Cl_2]Cl \cdot 2H_2O$
- (d) $[Co(H_2O)_3Cl_3] \cdot 3H_2O$

91. Which of the following expression correctly represents molar conductivity?

- (a) $\lambda_m = \frac{K}{C}$
- (b) $\lambda_m = \frac{KA}{l}$
- (c) $\lambda_m = KV$
- (d) All of these

92. The plot that represents the zero order reaction is :



93. In acidic medium which of the following does not change its colour?

- (a) MnO_4^-
- (b) MnO_4^{2-}
- (c) CrO_4^{2-}
- (d) FeO_4^{2-}

94. Which of the following is the life saving mixture for an asthma patient ?

- (a) Mixture of helium and oxygen
 - (b) Mixture of neon and oxygen
 - (c) Mixture of xenon and nitrogen
 - (d) Mixture of argon and oxygen
95. The compounds $[PtCl_2(NH_3)_4]Br_2$ and $[PtBr_2(NH_3)_4]Cl_2$ constitutes a pair of
- (a) coordination isomers
 - (b) linkage isomers
 - (c) ionization isomers
 - (d) optical isomers
96. Tincture of iodine is the common name for
- (a) iodoform
 - (b) 2-iodopropane
 - (c) 2-3% iodine solution in alcohol-water
 - (d) iodobenzene
97. The monomers of buna-S rubber are
- (a) Isoprene and butadiene
 - (b) Butadiene and phenol
 - (c) Styrene and butadiene
 - (d) Vinyl chloride and sulphur
98. The number of nearest neighbours in a bcc unit cell is
- (a) 12
 - (b) 8
 - (c) 6
 - (d) 4
99. The cell potential for the following cell notation is approximately...
- (a) 0.51 V
 - (b) 1.5 V
 - (c) 2.0 V
 - (d) 2.5 V
100. In Williamson synthesis if tertiary alkyl halide is used than
- (a) ether is obtained in good yield
 - (b) ether is obtained in poor yield
 - (c) alkene is the only product
 - (d) a mixture of alkene as a major product and ether as a minor product forms.

MATHEMATICS

101. If $A = \begin{pmatrix} 1 & 0 \\ 1/2 & 1 \end{pmatrix}$, then A^{50} is

(a) $\begin{pmatrix} 1 & 0 \\ 0 & 50 \end{pmatrix}$

(b) $\begin{pmatrix} 1 & 0 \\ 50 & 1 \end{pmatrix}$

(c) $\begin{pmatrix} 1 & 25 \\ 0 & 1 \end{pmatrix}$

(d) None of these

102. The range of function $f(x) = \sin^{-1}(x - \sqrt{x})$ is equal to

(a) $[\sin^{-1}(-1/4), \pi/2]$

(b) $[\sin^{-1}(-1), \pi/2]$

(c) $[-\sin^{-1}(1/4), \pi/2]$

(d) $[-\sin^{-1}(1), \pi/2]$

103. If $\vec{a} = \hat{i} + 2\hat{j} - 3\hat{k}$ and $\vec{b} = 2\hat{i} - 3\hat{j} - \hat{k}$, then

(a) $|\vec{a} - \vec{b}| > |\vec{a}| + |\vec{b}|$

(b) $|\vec{a} - \vec{b}| > ||\vec{a}| - |\vec{b}||$

(c) $|\vec{a} + \vec{b}| < |\vec{a} - \vec{b}|$

(d) $|\vec{a} - \vec{b}| > |\vec{a} - \vec{b}|$

104. If $\sqrt{\frac{y}{x}} + 4\sqrt{\frac{x}{y}} = 4$, then $\frac{dy}{dx}$ is

(a) xy

(b) x/y

(c) -4

(d) 4

105. The function $f(x) = \tan^{-1}(\sin x + \cos x)$ is an increasing function in

(a) $(0, \pi/2)$

(b) $(-\pi/2, \pi/2)$

(c) $(\pi/4, \pi/2)$

(d) $(\pi/2, 3\pi/4)$

106. If $f(x) = ||x| - 1|$, then points, where $f(x)$ is not differentiable, is/are

(a) $0, 1$

(b) $\pm 1, 0$

(c) 0

(d) 1 only

107. $\int_{\pi/11}^{9\pi/22} \frac{dx}{1+\sqrt{\tan x}} =$

(a) $\pi/4$

(b) $\pi/22$

(c) $\pi/11$

(d) $7\pi/44$

108. Let $\vec{a} = \hat{i} + 2\hat{j} + \hat{k}$, $\vec{b} = \hat{i} - \hat{j} + \hat{k}$ and $\vec{c} = \hat{i} + \hat{j} - \hat{k}$. A vector in the plane of $\vec{a}$ and $\vec{b}$ whose projection on $\vec{c}$ is $\frac{1}{\sqrt{3}}$, is

(a) $4\hat{i} - \hat{j} + 4\hat{k}$

(b) $3\hat{i} + \hat{j} - 3\hat{k}$

(c) $2\hat{i} + \hat{j} - 2\hat{k}$

(d) $4\hat{i} + \hat{j} - 4\hat{k}$

109. Let p : I am brave. q : I will climb the Mount Everest. The symbolic form of a statement, 'I am neither brave nor I will climb the mount Everest' is

(a) $p \wedge q$

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

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

(d) $\sim p \wedge q$

110. If $x \neq 0$, then

$$\frac{\sin(\pi+x) \cos(\frac{\pi}{2}+x) \tan(\frac{3\pi}{2}-x) \cot(2\pi-x)}{\sin(2\pi-x) \cos(2\pi+x) \operatorname{cosec}(-x) \sin(\frac{3\pi}{2}+x)} =$$

(a) 0

(b) -1

(c) 1

(d) 2

111. $i^2 + i^3 + \dots + i^{4000} =$

(a) 1

(b) 0

(c) i

(d) $-i$

112. The number of all four digit numbers which begin with 4 and end with either zero or five is

- (a) 200
- (b) 64
- (c) 256
- (d) 32

113. The number of ways of distributing 500 dissimilar boxes equally among '50' persons is

- (a) $500!/(10!)^{50} \cdot 50!$
- (b) $500!/(50!)^{10} \cdot 10!$
- (c) $500!/(50!)^{10}$
- (d) $500!/(10!)^{50}$

114. Given, the function $f(x) = \frac{a^x + a^{-x}}{2}$ ($a > 2$), then $f(x+y) + f(x-y)$ is equal to

- (a) $f(x) - f(y)$
- (b) $f(y)$
- (c) $2f(x)f(y)$
- (d) $f(x)f(y)$

115. The point on the line $4x - y - 2 = 0$ which is equidistant from the point $(-5, 6)$ and $(3, 2)$ is

- (a) $(2, 6)$
- (b) $(4, 14)$
- (c) $(1, 2)$
- (d) $(3, 10)$

116. The equation of a circle with centre $(5, 4)$ and touch the Y-axis is

- (a) $x^2 + y^2 - 10x - 8y - 16 = 0$
- (b) $x^2 + y^2 - 10x - 8y + 16 = 0$
- (c) $x^2 + y^2 + 10x + 8y + 16 = 0$
- (d) $x^2 + y^2 - 10x - 8y + 16 = 0$

117. $\lim_{\theta \rightarrow \frac{\pi}{4}} \frac{\cos \theta + \sin \theta}{\theta + \frac{\pi}{4}} =$

- (a) -1
- (b) 1
- (c) $\sqrt{2}$
- (d) $1/\sqrt{2}$

118. Marks of 5 students of a group are 8, 12, 13, 15 and 22, then find the variance.

- (a) 22.1

- (b) 23
- (c) 20.2
- (d) 21.2

119. If two numbers p and q are chosen randomly from the set $\{1, 2, 3, 4\}$ with replacement, then the probability that $p^2 \geq 4q$ is equal to

- (a) $1/4$
- (b) $3/16$
- (c) $1/2$
- (d) $7/16$

120. Let $F(\alpha) = \begin{pmatrix} \cos \alpha & -\sin \alpha & 0 \\ \sin \alpha & \cos \alpha & 0 \\ 0 & 0 & 1 \end{pmatrix}$ where $\alpha \in R$. Then $[F(\alpha)]^{-1}$ is equal to

- (a) $F(-\alpha)$
- (b) $F(\alpha^{-1})$
- (c) $F(2\alpha)$
- (d) None of these

121. Let $\vec{a}$, $\vec{b}$ and $\vec{c}$ be non-zero vectors such that $|(\vec{a} \times \vec{b}) \times \vec{c}| = \frac{1}{3}|\vec{b}||\vec{c}||\vec{a}|$. If θ is the acute angle between the vectors $\vec{b}$ and $\vec{c}$, then $\sin \theta$ equals

- (a) $\frac{2\sqrt{2}}{3}$
- (b) $\frac{\sqrt{2}}{3}$
- (c) $\frac{2}{3}$
- (d) $\frac{1}{3}$

122. Let the foot of the perpendicular from the point $(1, 2, 4)$ on the line $\frac{x+2}{4} = \frac{y-1}{2} = \frac{z+1}{3}$ be P. Then the distance of P from the plane $3x + 4y + 12z + 23 = 0$

- (a) 5
- (b) $50/13$
- (c) 4
- (d) $63/13$

123. If one of the lines given by $6x^2 - xy + 4cy^2 = 0$ is $3x + 4y = 0$, then c equals

- (a) -3
- (b) 1
- (c) 3
- (d) 1

124. If $x = a(\cos \theta + \theta \sin \theta)$, $y = a(\sin \theta - \theta \cos \theta)$, then $\frac{d^2y}{dx^2} =$
- (a) $\frac{\sec^3 \theta}{a\theta}$
 - (b) $\frac{\sec^2 \theta}{\theta}$
 - (c) $a\theta \cos^3 \theta$
 - (d) $\frac{\sec^2 \theta}{a}$
125. The absolute maximum value of the function $f(x) = 2x^3 - 3x^2 - 36x + 9$ defined on $[-3, 3]$ is
- (a) 36
 - (b) 53
 - (c) 63
 - (d) 72
126. Define $f(x) = \begin{cases} x^2 + bx + c, & x < 1 \\ x, & x \geq 1 \end{cases}$. If $f(x)$ is differentiable at $x = 1$, then $(b - c)$ is equal to
- (a) -2
 - (b) 0
 - (c) 1
 - (d) 2
127. The Boolean expression $(\sim (p \wedge q)) \vee q$ is equivalent to :
- (a) $q \rightarrow (p \wedge q)$
 - (b) $p \rightarrow q$
 - (c) $p \rightarrow (p \rightarrow q)$
 - (d) $p \rightarrow (p \vee q)$
128. If $x = \frac{1-t^2}{1+t^2}$ and $y = \frac{2t}{1+t^2}$, then $\frac{dy}{dx}$ is equal to
- (a) $-\frac{y}{x}$
 - (b) $\frac{y}{x}$
 - (c) $\frac{x}{y}$
 - (d) $-\frac{x}{y}$
129. The tangent at the point (x_1, y_1) on the curve $y = x^3 + 3x^2 + 5$ passes through the origin, then (x_1, y_1) does NOT lie on the curve:
- (a) $x^2 + \frac{y^2}{81} = 2$
 - (b) $\frac{y^2}{9} - x^2 = 8$
 - (c) $y = 4x^2 + 5$

(d) $\frac{x^2}{3} - y^2 = 2$

130. The value of $\int \frac{x \sin^{-1} x}{\sqrt{1-x^2}} dx$ is equal to :

- (a) $\sqrt{(1-x^2)} \sin^{-1} x + C$
 (b) $x \sin^{-1} x + C$
 (c) $x - \sqrt{(1-x^2)} \sin^{-1} x + C$
 (d) $\sqrt{(\sin^{-1} x)} + C$

131. $\int \frac{x+1}{x(1+xe^x)} dx$ is equal to

- (a) $\log \left| \frac{1+xe^x}{xe^x} \right| + C$
 (b) $\log \left| \frac{xe^x}{1+xe^x} \right| + C$
 (c) $\log |xe^x(1+xe^x)| + C$
 (d) $\log |1+xe^x| + C$

132. The order and degree of the differential equation $\sqrt[3]{\frac{dy}{dx} - 4\frac{d^2y}{dx^2}} - 7x = 0$ are respectively

- (a) 1 and 1/2
 (b) 2 and 1
 (c) -1 and 1
 (d) 1 and 2

133. Let $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = \hat{i} + 3\hat{j} + 5\hat{k}$ and $\vec{c} = 7\hat{i} + 9\hat{j} + 11\hat{k}$, then the area of parallelogram having diagonals $\vec{a} + \vec{b}$ and $\vec{b} + \vec{c}$ is

- (a) $4\sqrt{6}$ sq units
 (b) $4\sqrt{6}$ sq units
 (c) $\sqrt{6}$ sq units
 (d) $6\sqrt{6}$ sq units

134. If X is a random variable such that $P(X = -2) = P(X = -1) = P(X = 2) = P(X = 1) = 1/6$ and $P(X = 0) = 1/3$, then the mean of X is

- (a) $5/3$
 (b) 1
 (c) 0
 (d) $3/5$

135. $\int e^x \left(\frac{2+\sin 2x}{1+\cos 2x} \right) dx =$

- (a) $e^x \sec x + C$
 (b) $e^x \tan x + C$

(c) $e^x \cot x + C$

(d) $e^x \operatorname{cosec} x + C$

136. The solution of the differential equation $y^2 dx + (x^2 - xy + y^2) dy = 0$ is

(a) $\tan^{-1} \left(\frac{x}{y} \right) + \ln y + C = 0$

(b) $2 \tan^{-1} \left(\frac{x}{y} \right) + \ln x + C = 0$

(c) $\ln(v + \sqrt{x^2 + y^2}) + \ln y + C = 0$

(d) $\ln(x + \sqrt{x^2 + y^2}) + C = 0$

137. The lines whose vector equations are $\vec{r} = 2\hat{i} - 3\hat{j} + 7\hat{k} + \lambda(2\hat{i} + p\hat{j} + 5\hat{k})$ and $\vec{r} = \hat{i} - 2\hat{j} + 3\hat{k} + \mu(3\hat{i} + p\hat{j} + p\hat{k})$ are perpendicular for all values of λ and μ if $p =$

(a) 1

(b) -1

(c) -6

(d) 6

138. $\sin \left(\tan^{-1} \frac{4}{5} + \tan^{-1} \frac{1}{3} + \tan^{-1} \frac{1}{9} - \tan^{-1} \frac{1}{7} \right)$ is equal to

(a) $1/2$

(b) $1/\sqrt{2}$

(c) $\sqrt{3}/2$

(d) 1

139. Let $f(x) = \frac{2 - \sqrt{x+4}}{\sin 2x}$, $x \neq 0$. In order that $f(x)$ is continuous at $x = 0$, $f(0)$ is to be defined as

(a) $-1/8$

(b) $1/2$

(c) 1

(d) $1/8$

140. $\int_0^{\pi/4} \frac{\cos^2 x}{\cos^2 x + 4 \sin^2 x} dx =$

(a) $\frac{\pi}{4} + \frac{2}{3} \tan^{-1} 2$

(b) $\frac{\pi}{3} - \frac{2}{3} \tan^{-1} 3$

(c) $\frac{\pi}{12} + \frac{2}{3} \tan^{-1} 2$

(d) $\frac{\pi}{6} - \frac{2}{3} \tan^{-1} 4$

141. The area of the region described by $\{(x, y) / x^2 + y^2 \leq 1 \text{ and } y^2 \leq 1 - x\}$ is

(a) $\frac{\pi}{2} - \frac{2}{3}$

(b) $\frac{\pi}{2} + \frac{2}{3}$

(c) $\frac{\pi}{2} + \frac{4}{3}$

(d) $\frac{\pi}{2} - \frac{4}{3}$

142. Two players A and B are alternately throwing a coin and a die together. A player who first throws head and 6 wins the game. If A starts the game, then the probability that B wins the game is

(a) $12/23$

(b) $11/23$

(c) $5/119$

(d) $12/119$

143. Let the following system of equations

$$kx + y + z = 1$$

$$x + ky + z = k$$

$$x + y + kz = k^2$$

has no solution. Find $|k|$.

0

(a) 1

(b) 2

(c) 3

144. If $f(x)$ is differentiable at $x = 1$ and $\lim_{h \rightarrow 0} \frac{1}{h} f(1+h) = 5$, then $f'(1)$ is equal to

(a) 6

(b) 5

(c) 4

(d) 3

145. The area of the region $\{(x, y) : 0 \leq y \leq x^2 + 1, 0 \leq y \leq x + 1, 0 \leq x \leq 2\}$ is

(a) $23/6$

(b) $2\sqrt{2} + 5$

(c) $9/2$

(d) None of these

146. The solution of the differential equation $\sqrt{1-y^2}dx + xdy - \sin^{-1}y dy = 0$, is

(a) $x = \sin^{-1}y - 1 + ce^{-\sin^{-1}y}$

(b) $y = x\sqrt{1-y^2} + \sin^{-1}y + c$

(c) $x = 1 + \sin^{-1}y + ce^{\sin^{-1}y}$

(d) $y = \sin^{-1}y - 1 + x\sqrt{1-y^2} + c$

147. Let X be the discrete random variable representing the number (x) appeared on the face of a biased die when it is rolled. The probability distribution of X is
- | | | | | | | |
|------------|-----|------|-----|------|-----|-----|
| $X = x$ | 1 | 2 | 3 | 4 | 5 | 6 |
| $P(X = x)$ | 0.1 | 0.15 | 0.3 | 0.25 | k | k |
- Then variance of X is
- 1.64
 - 1.93
 - 2.16
 - 2.28
148. If vector equation of the line $\frac{x-2}{2} = \frac{y-5}{-3} = z+1$, is $\vec{r} = (2\hat{i} + \frac{5}{2}\hat{j} - \hat{k}) + \lambda(2\hat{i} - \frac{3}{2}\hat{j} + p\hat{k})$ then p is equal to
- 0
 - 1
 - 2
 - 3
149. Which of the following is correct ?
- $B'AB$ is symmetric if A is symmetric.
 - $B'AB$ is skew-symmetric if A is symmetric.
 - $B'AB$ is symmetric if A is skew-symmetric.
 - $B'AB$ is symmetric if A is skew-symmetric.
150. A spherical iron ball 10 cm in radius is coated with a layer of uniform thickness that melts at a rate of $50 \text{ cm}^3/\text{min}$. When the thickness of ice is 15 cm, then the rate at which the thickness of ice decreases, is
- $\frac{5}{6\pi} \text{ cm/min}$
 - $\frac{1}{54\pi} \text{ cm/min}$
 - $\frac{1}{18\pi} \text{ cm/min}$
 - $\frac{1}{36\pi} \text{ cm/min}$