

MHT CET 2020 Mathematics Memory Based Question Paper PDF

Section: Physics

Q.1 A thin, uniform metal rod of mass 'M' and length 'L' is swinging about a horizontal axis passing through its end. Its maximum angular velocity is ' ω '. Its centre of mass rises to a maximum height of (g = acceleration due to gravity)

1. $\frac{L^2\omega^2}{6g}$
2. $\frac{L^2\omega^2}{g}$
3. $\frac{L^2\omega^2}{2g}$
4. $\frac{L^2\omega^2}{3g}$

Q.2 A series LCR circuit has $R = 200 \Omega$, $L = 663 \text{ mH}$ and $C = 26.5 \mu\text{F}$. The applied alternating voltage has an amplitude of 50 V and a frequency of 60 Hz so that $X_L = 250 \Omega$ and $X_C = 100 \Omega$. The peak current is

1. 0.33 A
2. **0.20 A**
3. 0.50 A
4. 0.25 A

Q.3 Two masses of 1 gram and 4 gram are moving with equal kinetic energy. The ratio of the magnitudes of their momenta is

1. 4 : 1
2. $\sqrt{2} : 1$
3. **1 : 2**
4. 1 : 16

Q.4 If the frequency of incident radiation is kept constant and the experiment is repeated by using incident light of different intensities, then stopping potential (V_s)

1. increases with increase in intensity.
2. decreases with increase in intensity.

3. depends upon current.

4. **remains same.**

Q.5 The electron in hydrogen atom is moving in an orbit of radius $0.53\text{\AA}$. It takes 1.571×10^{-16} s to complete one revolution. The velocity of electron will be [$\pi = 3.142$]

1. 5.3×10^6 m/s

2. 4×10^6 m/s

3. 3×10^8 m/s

4. **2.12×10^6 m/s**

Q.6 A resonance tube completely filled with water has a small hole at the bottom. Length of the tube is 0.8 m. A vibrating tuning fork of frequency 500 Hz is held near the open end of tube. Water is slowly removed from the bottom. The maximum number of resonances heard will be (Neglect end correction. Speed of sound in air = 340 m/s)

1. 5

2. 4

3. **2**

4. 3

Q.7 If ' ΔQ ' is the amount of heat supplied to 'n' moles of a diatomic gas at constant pressure, ' ΔU ' is the change in internal energy and ' ΔW ' is the work done, then $\Delta W : \Delta U : \Delta Q$ is

1. 2 : 3 : 4

2. 1 : 2 : 3

3. **2 : 5 : 7**

4. 5 : 7 : 9

Q.8 The width of depletion layer of a p-n junction diode, when it is (i) forward biased and (ii) reverse biased respectively

1. increases and increases.

2. decreases and decreases.

3. increases and decreases.
4. **decreases and increases.**

Q.9 The relative angular speed of hour hand and second hand of a clock is

1. $\frac{359\pi}{21600}$
2. $\frac{719\pi}{21600}$
3. $\frac{11\pi}{21600}$
4. $\frac{9\pi}{21600}$

Q.10 Water rises to height 2.2 cm in glass capillary tube. The height to which same water rises in another capillary having $\frac{1}{4}$ th area of cross-section is

1. 16.4 cm
2. **4.4 cm**
3. 8.4 cm
4. 2.2 cm

Q.11 In hydrogen spectrum, which of the following spectral series lies in ultraviolet region?

1. Pfund
2. **Lyman**
3. Paschen
4. Brackett

Q.12 If $\vec{A} = \hat{i} + 12\hat{j} + \hat{k}$ and $\vec{B} = 2\hat{i} - a\hat{j} + \hat{k}$ are perpendicular to each other, then what will be the value of 'a'?

1. **0.5**
2. -0.5
3. 1
4. -1

Q.13 For any two vectors $\vec{A}$ and $\vec{B}$ if $\vec{A} \cdot \vec{B} = |\vec{A} \times \vec{B}|$, the magnitude of $(\vec{A} + \vec{B})$ is $(\tan \frac{\pi}{4} = 1, \cos \frac{\pi}{4} = \frac{1}{\sqrt{2}})$

1. $\sqrt{\mathbf{A}^2 + \mathbf{B}^2 + \sqrt{2}\mathbf{AB}}$

2. $\sqrt{A^2 + B^2 + \frac{AB}{\sqrt{2}}}$

3. $A + B$

4. $\sqrt{A^2 + B^2}$

Q.14 A particle performs S.H.M. Its potential energies are ' U_1 ' and ' U_2 ' at displacements ' x_1 ' and ' x_2 ' respectively. At displacement $(x_1 + x_2)$, its potential energy ' U ' is

1. $\sqrt{U} = \sqrt{U_1} + \sqrt{U_2}$

2. $\sqrt{U} = (\sqrt{U_1} + \sqrt{U_2})^2$

3. $\sqrt{U} = \sqrt{U_1} - \sqrt{U_2}$

4. $\sqrt{U} = (\sqrt{U_1} - \sqrt{U_2})^2$

Q.15 The equation of vibration of a stretched string fixed at both ends and vibrating in 5th harmonic is $Y = 3 \sin(0.4x) \cos(200\pi t)$ where ' x ' and ' Y ' are in cm and t in second. Length of the string is

1. $(10.5)\pi$ cm

2. $(8.5)\pi$ cm

3. **$(12.5)\pi$ cm**

4. $(4.5)\pi$ cm

Q.16 The acceleration due to gravity on moon is $(\frac{1}{6})^{\text{th}}$ times the acceleration due to gravity on earth. If the ratio of the density of earth ' ρ_e ' to the density of moon ' ρ_m ' is $\frac{5}{3}$, then the radius of moon ' R_m ' in terms of the radius of earth ' R_e ' is

1. $(\frac{7}{6})R_e$

2. $(\frac{3}{18})R_e$

3. **$(\frac{5}{18})R_e$**

4. $(\frac{1}{2\sqrt{3}})R_e$

Q.17 The length of potentiometer wire is 4m and is connected in series with an accumulator. The e.m.f. (Unknown) of a cell balances against 1.5 m length of wire. If the length of potentiometer wire is doubled, then the new balancing length of wire will be

1. 4.5 m
2. 1.5 m
3. 0.75 m
4. **3 m**

Q.18 A transverse wave is travelling with velocity 'V' through a metal wire of length 'L' and density ' ρ '. The tensile stress in the wire is

1. $V\rho^2$
2. V^2/ρ
3. ρ/V^2
4. **$V^2\rho$**

Q.19 The value of current (I) in the given current distribution is:

1. **0.7 A**
2. 0.4 A
3. 0.6 A
4. 0.5 A

Q.20 In common emitter mode of transistor, the d.c. current gain is 20, the emitter current is 7 mA. The collector current is

1. 16/3 mA
2. 13/3 mA
3. 8/3 mA
4. **20/3 mA**

Q.21 In experiment of photoelectric effect, the stopping potential for a given metal is ' V_0 ' volt, when radiation of wavelength ' λ_0 ' is used. If radiation of wavelength ' $2\lambda_0$ ' is used for the same metal, then the stopping potential (in volt) will be

1. $V_0 + \frac{hc}{2e\lambda_0}$
2. **$V_0 - \frac{hc}{2e\lambda_0}$**

3. $\frac{V_0}{2}$

4. $2V_0$

Q.22 A metal sphere of mass 'm' and density ' σ_1 ' falls with terminal velocity through a container containing liquid. The density of liquid is ' σ_2 '. The viscous force acting on the sphere is

1. $mg(1 - \frac{\sigma_1}{\sigma_2})$

2. $mg(1 - \frac{\sigma_2}{\sigma_1})$

3. $mg(1 + \frac{\sigma_1}{\sigma_2})$

4. $mg(1 + \frac{\sigma_2}{\sigma_1})$

Q.23 The quantity $\frac{PV}{KT}$ represents (K = Boltzmann constant)

1. number of moles of gas.

2. kinetic energy of gas.

3. mass of the gas.

4. **number of molecules of gas in one mole.**

Q.24 The sensitivity of moving coil galvanometer is inversely proportional to

1. current it measures.

2. number of turns in the coil.

3. magnetic induction of horse shoe magnet.

4. **twist constant of phosphor bronze wire.**

Q.25 In a biprism experiment, the slit separation is 1 mm. Using monochromatic light of wavelength $5000\text{\AA}$, an interference pattern is obtained on the screen. Where should the screen be moved, so that the change in fringe width is 12.5×10^{-5} m?

1. **Away or towards the slit by 25 cm**

2. Away or towards the slit by 12.5 cm

3. Away from the slit by 5 cm

4. Towards the slit by 10 cm

Q.26 Force $F = P \cos(Ax) + Q \sin(Bt)$ where x and t are displacement and time respectively.

Which one of the following physical quantity has the dimensions of $[\frac{B}{A}]$?

1. velocity gradient
2. **velocity**
3. angular velocity
4. angular momentum

Q.27 A train has to negotiate a curve of radius ' r ' m, the distance between the rails is ' l ' m and outer rail is raised above inner rail by distance of ' h ' m. If the angle of banking is small, the safety speed limit on this banked road is

1. $\sqrt{rg(\frac{h}{l})}$
2. $rg\frac{h}{l}$
3. $(\frac{h}{l})^2/rg$
4. $(rg\frac{h}{l})^2$

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

1. $1/2\epsilon_0 EA/d$
2. **$1/2\epsilon_0 E^2 Ad$**
3. $1/2\epsilon_0 Ad/E^2$
4. $1/2\epsilon_0 E^2 A/d$

Q.29 A capacitor of unknown capacitance C is connected across a battery of V volt. The charge stored in it becomes Q coulomb. When potential across the capacitor is reduced by V' volt, the charge stored in it becomes Q' coulomb. The capacitance C is

1. $(Q - Q')/\sqrt{V'}$
2. $V'/(Q - Q')$
3. $(Q + Q')/V'$
4. **$(Q - Q')/V'$**

Q.30 In a sphere of influence, the liquid molecule at its centre is

1. **attracted by other molecules in the sphere of influence.**
2. repelled by other molecules lying outside the sphere of influence.
3. attracted by other molecules lying outside the sphere of influence.
4. repelled by other molecules in the sphere of influence.

Q.31 A rubber ball be taken in a deep sea so that its volume is decreased by $X\%$. The bulk modulus of rubber is ' K ' and density of sea water is ' ρ '. The depth to which a rubber ball is taken is proportional to (g = acceleration due to gravity)

1. $\rho X/Kg$
2. **$Kx/\rho g$**
3. $\rho g/Kx$
4. ρ/Kxg

Q.32 A circular arc of radius ' r ' carrying current ' I ' subtends on angle $\pi/16$ at its centre. The radius of a metal wire is uniform. The magnetic induction at the centre of circular arc is

1. $\mu_0 I/16r$
2. $\mu_0 I/32r$
3. **$\mu_0 I/64r$**
4. $\mu_0 I/8r$

Q.33 The speed of a wave in a certain medium is 960 m/s. If 900 waves pass over a certain point of the medium in half a minute, the wavelength of the wave is

1. 16 m
2. **32 m**
3. 9 m
4. 18 m

Q.34 A convex lens of focal length ' F ' produces a real image ' n ' times the size of the object. The image distance is

1. $F(n + 1)$

2. $F(n - 1)$

3. $F/(n + 1)$

4. $F/(n - 1)$

Q.35 Two rings of same mass 'M' and radius 'R' are so placed that their centre is common and their planes are perpendicular to each other. The moment of inertia of the system about an axis passing through the centre and perpendicular to any one ring is

1. $\frac{3MR^2}{2}$

2. $\frac{MR^2}{2}$

3. $\frac{2MR^2}{3}$

4. MR^2

Q.36 In LCR circuit the inductance is changed from L to $9L$. For same resonant frequency the capacitance should be changed from C to

1. $9C$

2. $3C$

3. $C/9$

4. $C/3$

Q.37 An object is immersed in a fluid of refractive index ' μ '. In order that the object becomes invisible when observed from outside, it should

1. have refractive index equal to one.

2. **have refractive index same as surrounding fluid, that is ' μ '.**

3. absorb all light falling on it.

4. behave as a perfect reflector.

Q.38 How much energy is imparted to an electron so that its de-Broglie wavelength reduces from 10^{-10} m to 0.5×10^{-10} m? (E = energy of electron)

1. $4E$

2. $2E$

3. $3E$

4. E

Q.39 A horizontal spring executes S.H.M. with amplitude ' A_1 ', when mass ' m_1 ' is attached to it. When it passes through mean position another mass ' m_2 ' is placed on it. Both masses move together with amplitude ' A_2 '. Therefore $A_2 : A_1$ is

1. $[m_2/(m_1 + m_2)]^{1/2}$

2. $[(m_1 + m_2)/m_1]^{1/2}$

3. $[m_1/(m_1 + m_2)]^{1/2}$

4. $[(m_1 + m_2)/m_2]^{1/2}$

Q.40 According to Abbe, in the formula for resolving power of microscope, the numerical aperture is represented by

1. $2\mu \sin \alpha / \lambda$

2. $2 \sin \alpha / \mu \lambda$

3. $\mu \sin \alpha$

4. $2\mu \sin \alpha$

Q.41 A steel wire of length ' L ' and area of cross-section ' A ' is suspended from rigid support. If ' Y ' is the Young's modulus of material of the wire and ' α ' is the coefficient of linear expansion, then the increase in tension when temperature falls by $t^\circ\text{C}$ is

1. $YA/\alpha t$

2. $YA\alpha t$

3. $Y\alpha t$

4. $L\alpha t/Y$

Q.42 The materials having negative magnetic susceptibility are

1. paramagnetic.

2. **diamagnetic.**

3. ferromagnetic.
4. both paramagnetic and ferromagnetic.

Q.43 A wire of magnetic material of length '2L' and magnetic moment 'M' is bent at the centre to form 'L' shaped wire. Its magnetic moment is

1. $M/\sqrt{2}$
2. M
3. $M/\sqrt{3}$
4. $M/2$

Q.44 The linear displacement 'x' of the bob of simple pendulum from its mean position varies as $x = a \sin(\frac{\pi}{\sqrt{2}}t)$ where 'a' is its amplitude expressed in metre and 't' is in second. The length of simple pendulum is (Take $g = \pi^2 \text{ m/s}^2$)

1. 1.5 m
2. 3.0 m
3. **2.0 m**
4. 2.5 m

Q.45 Let ' μ_1 ' and ' μ_2 ' be the refractive indices of two media. ' v_1 ' and ' v_2 ' are the velocities of light in the media respectively. Which one of the following relations is TRUE?

1. $\mu_1 \mathbf{V}_1 = \mu_2 \mathbf{V}_2$
2. $\mu_2 V_1 = \mu_1 V_2$
3. $\mu_1 V_1^2 = \mu_2 V_2^2$
4. $\mu_2^2 V_1 = \mu_1^2 V_2$

Q.46 A toroid has a non-ferromagnetic wire of inner radius ' r_1 ' and outer radius ' r_2 ', around which 'N' turns of wire are wound. If the current in the wire is 'I', then the magnetic field inside the toroid is (μ_0 = permeability of free space)

1. $\frac{\mu_0 \mathbf{NI}}{\pi(\mathbf{r_1+r_2})}$
2. $\frac{\mu_0 NI}{(r_2-r_1)}$

3. $\frac{\mu_0 NI}{(r_1 + r_2)}$

4. $\frac{\mu_0 NI}{\pi(r_2 - r_1)}$

Q.47 A body of mass 5 kg is moving in a straight line. The relation between its displacement and time is $x = (t^3 - 2t - 10)$ m. What is the force acting on it at the end of 5 second?

1. **150 N**
2. 120 N
3. 80 N
4. 100 N

Q.48 The length of seconds pendulum is 1m on the earth. If the mass and diameter of the planet is double than that of the earth, then the length of the seconds pendulum on the planet will be

1. 0.2 m
2. 0.4 m
3. 0.3 m
4. **0.5 m**

Q.49 In communication system, for a given block diagram of receiver, the boxes 'X' and 'Y' respectively represent

1. Detector and amplifier
2. **IF stage and amplifier**
3. IF stage and detector
4. Amplifier and IF stage

Q.50 A torque of 50 Nm acts on a body for 8 second which is initially at rest. The change in its angular momentum is

1. **400 kgm²/s**
2. 600 kgm²/s
3. 1000 kgm²/s
4. 800 kgm²/s

Section: Chemistry

Q.1 Which from following elements has lowest tendency to form its oxide?

1. Al
2. Fe
3. Cr
4. **Hg**

Q.2 Which of the following amines can not be prepared by Gabriel phthalimide synthesis?

1. Ethylamine
2. Sec-butylamine
3. **Aniline**
4. Isopropylamine

Q.3 Which ligand among the following has highest splitting power of d-orbitals of central metal ion?

1. S^{2-}
2. OH^-
3. NCS
4. **CO**

Q.4 Which of the following is NOT an antacid?

1. $Al(OH)_3$
2. $Mg(OH)_2$
3. **Na_2CO_3**
4. $NaHCO_3$

Q.5 What is the quantity of glucose obtained when 68.4 g of sucrose is hydrolyzed in laboratory under ideal condition ? (molar mass of sucrose = 342 g mol^{-1})

1. 198.0 g

2. 180 g
3. 68.4 g
4. **36.0 g**

Q.6 What is the relation between cell constant, conductivity and electrical resistance?

1. $k = R/b$
2. **$k = b/R$**
3. $k = 1/(R \cdot b)$
4. $k = R \cdot b$

Q.7 An element crystallises in bcc type crystal structure with edge length of unit cell 300 pm. Calculate radius of element ?

1. 2.299×10^{-8} cm
2. **1.299×10^{-8} cm**
3. 6.920×10^{-8} cm
4. 1.440×10^{-8} cm

Q.8 Which among the following is used as a source of oxygen in submarine in emergency breathing apparatus ?

1. **potassium superoxide**
2. sodium peroxide
3. rubidium superoxide
4. lithium monoxide

Q.9 What type of hybridization is present in PCl_5 molecule ?

1. sp^2 hybridization
2. sp^3 hybridization
3. **sp^3d hybridization**
4. sp^3d^2 hybridization

Q.10 Which among the following polymers belongs to the class elastomers?

1. Polystyrene
2. Nylon
3. **Neoprene**
4. Bakelite

Q.11 Sodium crystallises in bcc structure with radius 1.86×10^{-8} cm. Calculate the edge length of unit cell ?

1. **4.29×10^{-8} cm**
2. 6.20×10^{-8} cm
3. 8.05×10^{-8} cm
4. 3.72×10^{-8} cm

Q.12 Identify product A in the following reaction. $C_6H_5 - CONH_2 + H_2O + HCl \xrightarrow{\Delta} A$

1. **$C_6H_5 - COOH$**
2. $C_6H_5 - NH_2$
3. $C_6H_5 - COCl$
4. $C_6H_5 - CHO$

Q.13 Which among the following gases liquefy easily ?

1. oxygen
2. helium
3. **chlorine**
4. nitrogen

Q.14 Which of the following is NOT dicarboxylic acid?

1. Succinic acid
2. **Acrylic acid**
3. Malonic acid
4. Phthalic acid

Q.15 Which among the following is an example of Metal – metal ion electrode ?

1. $Fe^{3+}(aq.), Fe^{2+}(aq.) | Pt$
2. $Cl^{-}(aq.) | AgCl(s) | Ag$
3. $Zn^{2+}(aq.) | Zn(s)$
4. $OH^{-}(aq.) | O_2(g, PO_2) | Pt$

Q.16 What is the type of magnetic behavior and geometry respectively in Cuproammonium sulphate (Atomic no. of Cu = 29) ?

1. Paramagnetic and tetrahedral
2. Diamagnetic and pyramidal
3. Diamagnetic and tetrahedral
4. **Paramagnetic and square planar**

Q.17 Which among the following sources contains caryophyllene?

1. Peppermint
2. Oil of roses
3. Oil of ginger
4. **Oil of cloves**

Q.18 Which of following is o-acetylsalicylic acid

1. **Aspirin**
2. Equanil
3. Veronal
4. Valium

Q.19 Identify the ionic charge and magnetic nature respectively of manganate ion.

1. -1 , Diamagnetic
2. -2 , Diamagnetic
3. **-2 , Paramagnetic**
4. -1 , Paramagnetic

Q.20 Which of the following hydride is deficient in hydrogen ?

1. LiH
2. KH
3. **NiH**
4. NaH

Q.21 Identify Z in the following series of reactions: $CH_3-CH_2-CH_2-I \xrightarrow[\Delta]{KOH(alco.)} X \xrightarrow{HBr/peroxide} Y \xrightarrow[\Delta]{KCN/alcohol} Z$

1. **$CH_3 - CH_2 - CH_2 - CN$**
2. $CH_3 - CH_2 - CH_2 - Br$
3. $CH_3 - CH(CN) - CH_3$
4. $CH_3 - CH = CH_2$

Q.22 Solution of chloroform in nitrogen is an example of

1. **liquid in gas**
2. liquid in solid
3. liquid in liquid
4. gas in liquid

Q.23 When phenol reacts with dilute nitric acid at room temperature, the major product obtained is

1. p- nitrophenol
2. m- nitrophenol
3. 2,4,6-trinitrophenol
4. **o – nitrophenol**

Q.24 Identify the name of reaction in which alkyl fluorides are prepared by heating alkyl bromide with metallic fluorides ?

1. Sandmeyer reaction
2. Wurtz reaction
3. **Swarts reaction**

4. Finkelstein reaction

Q.25 Identify correct decreasing order of oxidizing power?

1. **$\text{HClO} > \text{HClO}_2 > \text{HClO}_3$**
2. $\text{HClO} > \text{HClO}_3 > \text{HClO}_2$
3. $\text{HClO}_2 > \text{HClO} > \text{HClO}_3$
4. $\text{HClO}_2 > \text{HClO}_3 > \text{HClO}$

Q.26 How many lone pair of electrons are present on chlorine atom in hypochlorous acid?

1. 1
2. **3**
3. 2
4. 4

Q.27 Which of the following groups does not show (+R) effect?

1. $-\text{NH}_2$
2. $-\text{NHCOR}$
3. **$-\text{CN}$**
4. $-\text{NR}_2$

Q.28 Which of the following is a product of first step and is used as reactant in next step for manufacture of $\text{K}_2\text{Cr}_2\text{O}_7$ from concentrated chromite ore ?

1. Sodium dichromate
2. Potassium chromate
3. Sodium sulphate
4. **Sodium chromate**

Q.29 Identify the monomers used in preparation of PHBV polymer.

1. Styrene and glycolic acid
2. Lactic acid and glycolic acid

3. **3 – Hydroxy butanoic acid and 3 – hydroxy pentanoic acid**

4. Glycine and ω amino caproic acid

Q.30 What is the oxidation number of Fe in $K_3[Fe(CN)_6]$?

1. -6

2. -3

3. **+3**

4. +6

Q.31 A reaction of phenol with chloroform in presence of sodium hydroxide to form salicylaldehyde is known as

1. **Reimer – Tiemann reaction**

2. Friedel craft's reaction

3. Stephens reaction

4. Kolbe's reaction

Q.32 According to molecular orbital theory, antibonding molecular orbitals of O_2 contain

1. **4 electrons**

2. 6 electrons

3. 10 electrons

4. 8 electrons

Q.33 Benzene diazonium chloride on reaction with aniline in mild alkaline medium forms

1. **yellow dye**

2. blue dye

3. red dye

4. orange dye

Q.34 What is the value of $\Delta S_{\text{(total)}}$ for following reaction at 300 K $Fe_2O_3(s) + 3CO(g) \rightarrow 2Fe(s) + 3CO_2(g)$ $\Delta H^\circ = -25 \text{ kJ}$, $\Delta S^\circ = 15 \text{ JK}^{-1}$

1. **68.2 JK⁻¹**

2. **98.3 JK⁻¹**

3. 8.32 JK⁻¹

4. -10.0 JK⁻¹

Q.35 Formation of p-hydroxyazobenzene from benzene diazonium chloride and phenol in mild alkaline medium is a

1. nucleophilic substitution
2. electrophilic addition
3. nucleophilic addition
4. **electrophilic substitution**

Q.36 What is the unit of rate constant for the zero order reaction?

1. **mol dm⁻³t⁻¹**
2. mol dm³t⁻¹
3. t⁻¹
4. mol dm⁻³t

Q.37 When HCl is treated with propene in presence of sodium peroxide, the major product obtained is

1. 1-Chloropropane
2. 1, 2-dichloropropane
3. **2 – Chloropropane**
4. 2, 2-dichloropropane

Q.38 Tyndall effect is observed due to

1. neutralization of charge on colloidal particles
2. Zig-zag motion of colloidal particles
3. precipitation of colloidal particles
4. **Scattering of light by colloidal particles**

Q.39 Which reaction from following occurs at 2000 K in the blast furnace for extraction of iron?

1. $CaO + SiO_2 \rightarrow CaSiO_3$
2. $CaCO_3 \rightarrow CaO + CO_2$
3. $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$
4. **$2C + O_2 \rightarrow 2CO$**

Q.40 How many moles of ethene are required to prepare 6.0 g ethane by hydrogenation process?

1. **0.2 mole**
2. 0.1 mole
3. 1.0 mole
4. 4.0 mole

Q.41 An amalgam of mercury with sodium is an example

1. solid in liquid solution
2. solid in solid solution
3. liquid in liquid solution
4. **liquid in solid solution**

Q.42 What is the volume of 1 mole of a crystalline solid having unit cell edge length 16×10^{-8} cm, if it's unit cell contains 24 molecules ?

1. **$102.7 \text{ cm}^3 \text{mol}^{-1}$**
2. $404.0 \text{ cm}^3 \text{mol}^{-1}$
3. $159.3 \text{ cm}^3 \text{mol}^{-1}$
4. $142.1 \text{ cm}^3 \text{mol}^{-1}$

Q.43 When methoxy benzene react with HI at room temperature the products formed are

1. Iodomethane and Iodobenzene
2. **Iodomethane and Phenol**
3. Methanol and Iodobenzene
4. Iodomethane and Benzene

Q.44 Which among the following is an example of zero order reaction?

1. **Decomposition of N_2O in presence of catalyst**

2. Inversion of $C_{12}H_{22}O_{11}$

3. Hydrolysis of CH_3COOCH_3

4. Decomposition of N_2O_5

Q.45 Calculate the amount of work done during isothermal expansion of a gas from a volume of 4 dm^3 to 6 dm^3 against a constant external pressure of 3 atmosphere ?

1. -30.4 J

2. -60.8 J

3. **-607.8 J**

4. -6.0 J

Q.46 The SI unit of pressure is

1. $kg\ ms^{-2}$

2. $kg\ ms^2$

3. **$kg\ m^{-1}s^{-2}$**

4. $kg\ m^2s$

Q.47 Identify 'A' in the following reaction, $A \xrightarrow{Pd-BaSO_4, H_2} C_6H_5CHO + HCl$

1. Benzoic acid

2. Benzyl chloride

3. **Benzoyl chloride**

4. Chlorobenzene

Q.48 Which of following 0.1 m aqueous solution exhibits highest osmotic pressure at 25°C ?

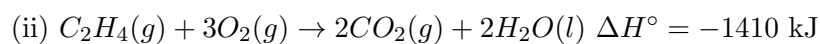
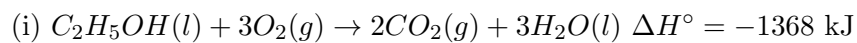
1. urea

2. **$CoCl_2$**

3. KCl

4. glucose

Q.49 What is the value of ΔH° for the formation of ethanol from ethene gas and liquid water from following data ?



1. -1326.0 kJ
2. -4188.0 kJ
3. **-42.0 kJ**
4. -2778.0 kJ

Q.50 Which of the following oxyacids of chlorine does not contain lone pair of electron on chlorine atom ?

1. $HOClO_2$
2. $HOCl$
3. **$HOClO_3$**
4. $HOClO$

Section: Mathematics

Q.1 With usual notations, in triangle ABC, $a = \sqrt{3}+1$, $b = \sqrt{3}-1$ and $m\angle C = 60^\circ$, then $A-B =$

1. 45°
2. 60°
3. 30°
4. **90°**

Q.2 If $AX = B$, where $A = \begin{bmatrix} 1 & -1 & 1 \\ 2 & -1 & 0 \\ 3 & 3 & -4 \end{bmatrix}$, $B = \begin{bmatrix} 1 \\ 1 \\ 2 \end{bmatrix}$ and $X = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$, then $x + y + z =$

1. 2
2. **3**
3. 6
4. 1

Q.3 If the points $A(5, k)$, $B(-3, 1)$ and $C(-7, -2)$ are collinear, then $k =$

1. **7**
2. $-1/7$
3. $1/7$
4. -7

Q.4 If $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ represents a joint equation of directrices of the hyperbola $16x^2 - 9y^2 = 144$, then $g + f - c =$

1. -81
2. -25
3. **81**
4. 25

Q.5 The population $P(t)$ of a certain mouse species at time t satisfies the differential equation $\frac{dP(t)}{dt} = 0.5P(t) - 450$. If $P(0) = 850$, then the time at which the population becomes zero is

1. $(\frac{1}{2}) \log 18$
2. $\log 18$
3. **$2 \log 18$**
4. $\log 9$

Q.6 If the points $(1, 1, \lambda)$ and $(-3, 0, 1)$ are equidistant from the plane $3x + 4y - 12z + 13 = 0$, then integer value of λ is

1. 2
2. **1**
3. 3
4. 4

Q.7 If $x = a(1 - \cos \theta)$, $y = a(\theta - \sin \theta)$, then $\frac{d^2y}{dx^2} =$

1. $\frac{\cos^2(\frac{\theta}{2})}{2a \operatorname{cosec} \theta}$
2. $\frac{\operatorname{cosec} \theta}{2a \cos^2(\frac{\theta}{2})}$
3. $\frac{\cos(\frac{\theta}{2})}{2a \sin \theta}$
4. $\frac{\sin(\frac{\theta}{2})}{2a \cos \theta}$

Q.8 If A and B are independent events and $P(A) = \frac{2}{3}$, $P(B) = \frac{3}{5}$, then $P(A' \cap B) =$

1. $\frac{4}{15}$
2. $\frac{3}{5}$
3. $\frac{2}{5}$
4. **$\frac{1}{5}$**

Q.9 The differential equation whose solution is $y = c_1 \cos ax + c_2 \sin ax$ (Where c_1 and c_2 are arbitrary constants) is

1. $\frac{d^2y}{dx^2} - a^2y = 0$
2. **$\frac{d^2y}{dx^2} + a^2y = 0$**
3. $\frac{d^2y}{dx^2} + ay^2 = 0$
4. $\frac{d^2y}{dx^2} + y^2 = 0$

Q.10 $\int \frac{\cos \sqrt{x}}{\sqrt{x}} dx =$

1. $\frac{1}{2} \cos \sqrt{x} + c$
2. $2 \sin \sqrt{x} + c$
3. $\frac{1}{2} \sin \sqrt{x} + c$
4. $2 \cos \sqrt{x} + c$

Q.11 If $f(x) = \frac{|x-2|}{x-2}$, for $x \neq 2$ and $= 1$, for $x = 2$, then which of the following statements is true?

1. $f(x)$ is continuous at $x = 2$
2. $\lim_{x \rightarrow 2^-} f(x) = f(2)$
3. $\lim_{x \rightarrow 2^+} f(x) = \lim_{x \rightarrow 2^-} f(x)$
4. **$f(x)$ is discontinuous at $x = 2$**

Q.12 If line $x + y = 0$ touches the curve $ax^2 = 2y^2 - b$ at $(1, -1)$, then the values of a and b are respectively

1. 0, 2
2. -2, 0
3. 0, -2
4. **2, 0**

Q.13 $\int \frac{dx}{\cos 2x + \sin^2 x} =$

1. $\sin x + c$
2. $\tan x + c$
3. $\sec^2 x + c$
4. $\cos x + c$

Q.14 $\sin 690^\circ \times \sec 240^\circ =$

1. **1**
2. -1
3. $\frac{-1}{2}$

4. $\frac{1}{2}$

Q.15 The equation of a plane containing the lines $\vec{r} = (\hat{i} + 2\hat{j} - 4\hat{k}) + \lambda(2\hat{i} + 3\hat{j} + 6\hat{k})$ and $\vec{r} = (\hat{i} + 3\hat{j} + 4\hat{k}) + \mu(\hat{i} + \hat{j} - \hat{k})$ is

1. $9x + 8y + z + 11 = 0$
2. $9x - 8y - z - 11 = 0$
3. $9x - 8y - z + 11 = 0$
4. **$9x - 8y + z + 11 = 0$**

Q.16 $2 \tan^{-1}(\frac{1}{3}) - \tan^{-1}(\frac{3}{4}) =$

1. **0**
2. 2
3. 1
4. 3

Q.17 The rate of decay of mass of a certain substance at time 't' is proportional to the mass at that instant. The time during which the original mass of m_0 gm will be left to m_1 gm is (K is constant of proportionality)

1. $K \log(\frac{m_1}{m_0})$
2. $(\frac{1}{K}) \log(\frac{m_1}{m_0})$
3. $(\frac{1}{K}) \log(\frac{m_0}{m_1})$
4. **$K \log(\frac{m_0}{m_1})$**

Q.18 If a, b, c are non-negative distinct numbers and $a\hat{i} + a\hat{j} + c\hat{k}$, $\hat{i} + \hat{k}$ and $c\hat{i} + c\hat{j} + b\hat{k}$ are coplanar vectors, then

1. a, c, b are in A.P.
2. a, b, c are in G.P.
3. **a, c, b are in G.P.**
4. a, b, c are in A.P.

Q.19 If foci of the ellipse $\frac{x^2}{16} + \frac{y^2}{b^2} = 1$ ($b^2 < 16$) and the hyperbola $\frac{x^2}{144} - \frac{y^2}{81} = \frac{1}{25}$ coincide, then the value of b^2 is

1. 4
2. 9
3. 14
4. **7**

Q.20 The principal value of $\sin^{-1}(-\frac{1}{2})$ is

1. $\frac{\pi}{3}$
2. $\frac{\pi}{6}$
3. $-\frac{\pi}{3}$
4. $-\frac{\pi}{6}$

Q.21 The separate equations of the lines represented by the equation $3x^2 - 2\sqrt{3}xy - 3y^2 = 0$ are

1. **$x - \sqrt{3}y = 0$ and $3x + \sqrt{3}y = 0$**
2. $x + \sqrt{3}y = 0$ and $3x + \sqrt{3}y = 0$
3. $x - \sqrt{3}y = 0$ and $3x - \sqrt{3}y = 0$
4. $x + \sqrt{3}y = 0$ and $3x - \sqrt{3}y = 0$

Q.22 If $A = \begin{bmatrix} 1 & 1 \\ 4 & 2 \end{bmatrix}$, $B = \begin{bmatrix} 4 & 1 \\ 3 & 1 \end{bmatrix}$, then $(A + B)^{-1} =$

1. $\frac{1}{7} \begin{bmatrix} 3 & 2 \\ 4 & 5 \end{bmatrix}$
2. $7 \begin{bmatrix} 3 & 2 \\ 4 & 5 \end{bmatrix}$
3. $\frac{1}{7} \begin{bmatrix} 3 & -2 \\ -4 & 5 \end{bmatrix}$
4. $7 \begin{bmatrix} 3 & -2 \\ -4 & 5 \end{bmatrix}$

Q.23 The verbal statement of the same meaning, of the statement 'If the grass is green then it rains in July' is

1. The grass is not green and it does not rains in July.

2. **The grass is not green or it rains in July.**
3. If the grass is not green, then it does not rain in July.
4. The grass is not green if and only if it rains in July.

Q.24 If $x = 3 \sin \theta$, $y = 3 \cos \theta \cos \phi$, $z = 3 \cos \theta \sin \phi$, then $x^2 + y^2 + z^2 =$

1. 18
2. 27
3. **9**
4. 3

Q.25 $\int_{-2}^1 [x+1] dx =$ (Where $[x]$ is greatest integer function not greater than x)

1. 1
2. **0**
3. -1
4. 2

Q.26 If the origin is the centroid of the triangle whose vertices are $A(2, p, -3)$, $B(q, -2, 5)$ and $C(-5, 1, r)$, then

1. $p = -1, q = 3, r = -2$
2. $p = 1, q = -3, r = -2$
3. $p = 1, q = 3, r = 2$
4. **$p = 1, q = 3, r = -2$**

Q.27 Write the statement in symbolic form 'Sandeep neither likes tea nor coffee but enjoys a soft drink'. Where p : Sandeep likes tea, q : Sandeep likes coffee, r : Sandeep enjoys a soft drink

1. $(\sim p \wedge q) \vee r$
2. **$(\sim p \wedge \sim q) \wedge r$**
3. $(\sim p \vee \sim q) \vee r$
4. $(\sim p \vee \sim q) \wedge r$

Q.28 If $f(x) = \frac{x+2}{18}$, $-2 < x < 4$ and $= 0$, otherwise, is the p. d. f. of a r. v. X , then the value of $P(|X| < 2)$ is

1. $\frac{5}{9}$
2. $\frac{4}{9}$
3. $\frac{2}{9}$
4. $\frac{1}{9}$

Q.29 The angle between the lines $\frac{x-1}{4} = \frac{y-3}{1} = \frac{z}{8}$ and $\frac{x-2}{2} = \frac{y+1}{2} = \frac{z-4}{1}$ is

1. $\sin^{-1}\left(\frac{2}{3}\right)$
2. $\cos^{-1}\left(\frac{2}{3}\right)$
3. $\cos^{-1}\left(\frac{1}{3}\right)$
4. $\sin^{-1}\left(\frac{1}{3}\right)$

Q.30 If the direction cosines of a line are $\frac{1}{c}, \frac{1}{c}, \frac{1}{c}$ then

1. $2 < c < 3$
2. $c = \pm 3$
3. $c = \pm\sqrt{3}$
4. $c = \pm\frac{1}{\sqrt{3}}$

Q.31 If $\frac{1}{4}, a, b, \frac{1}{19}$ form a H.P. then the values of a and b are respectively

1. $\frac{1}{12}, \frac{1}{15}$
2. $\frac{1}{5}, \frac{1}{7}$
3. $\frac{1}{9}, \frac{1}{14}$
4. $\frac{1}{11}, \frac{1}{17}$

Q.32 $\int_0^{\frac{\pi}{2}} (e^{\sin x} - e^{\cos x}) dx =$

1. $\frac{1}{2}$
2. **0**
3. 1
4. $\frac{\pi}{4}$

Q.33 The minimum value for the LPP $Z = 6x + 2y$, subject to $2x + y \geq 16, x \geq 6, y \geq 1$ is

1. **44**
2. 47
3. 24
4. 34

Q.34 A fair coin is tossed 2 times. A person receives X^3 if he gets X number of heads. His expected gain is =

1. 2.00
2. 1.00
3. **2.50**
4. 5.20

Q.35 If $\vec{a} = \hat{i} + 5\hat{k}, \vec{b} = 2\hat{i} + 3\hat{k}, \vec{c} = 4\hat{i} - \hat{j} + 2\hat{k}$ and $\vec{d} = \hat{i} - \hat{j}$, then $(\vec{c} - \vec{a}) \cdot (\vec{b} \times \vec{d}) =$

1. **12**
2. 20
3. 30
4. 10

Q.36 If $f(x) = x^2 - 3x + 4$ and $f(x) = f(2x + 1)$, then $x =$

1. **$-1, \frac{2}{3}$**
2. $-1, \frac{3}{2}$
3. $1, \frac{3}{2}$
4. $1, \frac{2}{3}$

Q.37 The area bounded by the parabola $y^2 = 16x$ and its latus - rectum in the first quadrant is

1. 128 sq. units
2. **$\frac{64}{3}$ sq. units**
3. $\frac{128}{3}$ sq. units
4. 64 sq. units

Q.38 20 meters wire is available to fence a flower bed in the form of a circular sector. If the flower bed should have the greatest possible surface area, then the radius of the circle is

1. 2m
2. 4m
3. **5m**
4. 10m

Q.39 If the radius of a circle $x^2 + y^2 - 4x + 6y - k = 0$ is 5, then $k =$

1. -12
2. -25
3. 25
4. **12**

Q.40 The equation of normal to the curve $2x^2 + 3y^2 - 5 = 0$ at $P(1, 1)$ is

1. $3x + 2y + 1 = 0$
2. $3x - 2y + 1 = 0$
3. $3x + 2y - 5 = 0$
4. **$3x - 2y - 1 = 0$**

Q.41 The shortest distance between the lines $1 + x = 2y = -12z$ and $x = y + 2 = 6z - 6$ is

1. 1 unit
2. 4 units
3. **2 units**
4. 3 units

Q.42 The particular solution of the differential equation $\cos\left(\frac{dy}{dx}\right) = a$, under the conditions $a \in \mathbb{R}$ and $y(0) = 2$ is

1. $\cos\left(\frac{x-2}{y}\right) = a$
2. $\cos^{-1}\left(\frac{y-2}{x}\right) = a$
3. $\cos\left(\frac{y-2}{x}\right) = a$

4. $\cos\left(\frac{x-2}{y+2}\right) = a$

Q.43 If $\sqrt{x+y} + \sqrt{y-x} = 5$, then $\left(\frac{d^2y}{dx^2}\right) =$

1. $\frac{2}{25}$

2. $\frac{2}{5}$

3. $\frac{-2}{5}$

4. $\frac{-2}{25}$

Q.44 The domain of a function $f(y) = \frac{\cos^{-1}(y-5)}{\sqrt{25-y^2}}$ is

1. $(4, 6]$

2. $(-5, 5)$

3. $[4, 5)$

4. $(4, 5]$

Q.45 In a box containing 100 bulbs, 10 are defective. The probability that out of 20 bulbs selected at random, none is defective is

1. $10\left(\frac{1}{10}\right)^{20}$

2. $20\left(\frac{9}{10}\right)^{20}$

3. $5\left(\frac{1}{10}\right)^{20}$

4. $\left(\frac{9}{10}\right)^{20}$

Q.46 $\int_0^1 \frac{x^2}{1+x^2} dx =$

1. $1 + \frac{\pi}{4}$

2. $1 - \frac{\pi}{4}$

3. $1 - \frac{\pi}{2}$

4. $1 + \frac{\pi}{2}$

Q.47 The general solution of the differential equation $(1-x^2)\frac{dy}{dx} + 2xy = x(1-x^2)^{\frac{1}{2}}$ is

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

2. $y = 2\sqrt{1-x^2} + c$

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

4. $y\sqrt{1-x^2} = c(1-x^2)$

Q.48 $\sin\left(\frac{\pi}{3} + x\right) - \cos\left(\frac{\pi}{6} + x\right) =$

1. $-\cos x$

2. $-\sin x$

3. $\cos x$

4. $\sin x$

Q.49 If $y = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots$ then $\frac{dy}{dx} =$

1. $y - 1$

2. $y + 1$

3. $y^2 - 1$

4. y

Q.50 $\int \frac{4e^x + 6e^{-x}}{9e^x - 4e^{-x}} dx = Ax + B \log |9e^{2x} - 4| + c$, then (Where c is constant of integration)

1. $A = \frac{3}{2}, B = \frac{35}{36}$

2. $A = \frac{1}{2}, B = \frac{35}{36}$

3. $A = \frac{-3}{2}, B = \frac{35}{36}$

4. $A = \frac{-3}{2}, B = \frac{36}{35}$