

MHT CET 2020 Mathematics Memory Based Question Paper PDF

Q.1 An electron moves in a circular orbit with uniform speed ' v '. It produces a magnetic field ' B ' at the centre of the circle. The radius of the circle is [μ_0 = permeability of free space, e = electronic charge]:

- (a) $\left(\frac{\mu_0 ev}{B}\right)^{1/2}$
- (b) $\frac{\mu_0 eB}{4\pi v}$
- (c) $\left(\frac{\mu_0 ev}{4\pi B}\right)^{1/2}$
- (d) $\frac{\mu_0 ev}{4\pi B}$

Q.2 Two circular loops A and B of radii ' R ' and ' NR ' respectively are made from a uniform wire. Moment of inertia of B about its axis is 3 times that of A about its axis. The value of N is:

- (a) $[5]^{1/3}$
- (b) $[3]^{1/3}$
- (c) $[4]^{1/3}$
- (d) $[2]^{1/3}$

Q.3 A uniform metal wire has length ' L ', mass ' M ' and density ' ρ '. It is under tension ' T ' and ' v ' is the speed of transverse wave along the wire. The area of cross-section of the wire is:

- (a) $\frac{v^2 \rho}{T}$
- (b) $\frac{T}{v^2 \rho}$
- (c) $T^2 \rho v$
- (d) $T v^2 \rho$

Q.4 Metal rings 'P' and 'Q' are lying in the same plane where current ' I ' is increasing steadily. The induced current in metal rings is shown correctly in figure: [Figure description: A straight wire carrying current I . Ring P is above, Ring Q is below.]

- (a) P: clockwise, Q: clockwise
- (b) P: anti-clockwise, Q: anti-clockwise
- (c) P: clockwise, Q: anti-clockwise
- (d) P: anti-clockwise, Q: clockwise

- Q.5** The fundamental frequency of a closed pipe is 400 Hz. If $1/3^{\text{rd}}$ pipe is filled with water, the frequency of 2^{nd} harmonic of the pipe will be (Neglect end correction):
- (a) 600 Hz
 - (b) 1800 Hz
 - (c) 1200 Hz
 - (d) 300 Hz
- Q.6** Two capacitors of capacities $2\mu\text{F}$ and $4\mu\text{F}$ are connected in parallel. A third capacitor of $6\mu\text{F}$ capacity is connected in series with this combination. A battery of 12 V is connected across this combination. The charge on $2\mu\text{F}$ capacitor is:
- (a) $12\mu\text{C}$
 - (b) $16\mu\text{C}$
 - (c) $14\mu\text{C}$
 - (d) $11\mu\text{C}$
- Q.7** The compressibility of water is $5 \times 10^{-10} \text{ m}^2/\text{N}$. Pressure of $15 \times 10^6 \text{ Pa}$ is applied on 100 ml volume of water. The change in the volume of water is:
- (a) 0.75 ml increase.
 - (b) 1.50 ml increase.
 - (c) 0.75 ml decrease.
 - (d) zero.
- Q.8** Let $x = \pi R \left(\frac{P^2 - Q^2}{2} \right)$, where P, Q and R are lengths. The physical quantity ' x ' is:
- (a) volume
 - (b) area
 - (c) velocity
 - (d) length
- Q.9** A milliammeter of resistance 40Ω has a range 0–30 mA. What will be the resistance used in series to convert it into voltmeter of range 0–15 V?
- (a) 640Ω
 - (b) 920Ω
 - (c) 560Ω
 - (d) 460Ω
- Q.10** Two bodies 'A' and 'B' of equal mass are suspended from two separate massless springs of force constant ' k_1 ' and ' k_2 ' respectively. The bodies oscillate vertically such that their maximum velocities are equal. The ratio of the amplitudes of body A to that of body B is:
- (a) $\sqrt{\frac{k_2}{k_1}}$
 - (b) $\frac{k_1}{k_2}$
 - (c) $\sqrt{\frac{k_1}{k_2}}$

(d) $\frac{k_2}{k_1}$

Q.11 Three point masses, each of mass ' m ' are placed at the corners of an equilateral triangle of side ' l '. The moment of inertia of the system about an axis passing through one of the vertices and parallel to the side joining other two vertices, will be:

- (a) $\frac{3}{2}ml^2$
- (b) $\frac{3}{4}ml^2$
- (c) $\frac{1}{2}ml^2$
- (d) $\frac{1}{4}ml^2$

Q.12 Two spherical rain drops reach the surface of the earth with terminal velocities having ratio 16 : 9. The ratio of their surface area is:

- (a) 4 : 3
- (b) 64 : 27
- (c) 16 : 9
- (d) 9 : 16

Q.13 van de Graaff generator produces:

- (a) low voltage and low current.
- (b) high voltage and high current.
- (c) high voltage and low current.
- (d) low voltage and high current.

Q.14 A metal rod has length, cross-sectional area and Young's modulus as ' L ', ' A ' and ' Y ' respectively. If the elongation in the rod produced is ' l ' then work done is proportional to:

- (a) l
- (b) l^4
- (c) l^2
- (d) l^3

Q.15 By increasing the aperture of the objective lens, wavelength of light, focal length of the objective lens and the resolving power of an astronomical telescope respectively:

- (a) is not affected, increases, decreases.
- (b) increases, decreases, is not affected.
- (c) decreases, increases, is not affected.
- (d) is not affected, decreases, increases.

Q.32 A tuning fork 'A' produces 5 beats per second with a tuning fork of frequency 480 Hz. When a little wax is stuck to a prong of fork A, the number of beats heard per second becomes 2. What is the frequency of tuning fork A before the wax is stuck to it?

- (a) 485 Hz
- (b) 478 Hz

- (c) 475 Hz
- (d) 482 Hz

Q.40 Two cells having unknown e.m.f.s E_1 and E_2 ($E_1 > E_2$) are connected in potentiometer circuit so as to assist each other. The null point obtained is at 490 cm from the higher potential end. When cell E_2 is connected so as to oppose cell E_1 , the null point is obtained at 90 cm from the same end. The ratio of the e.m.f.s of two cells (E_1/E_2) is:

- (a) 0.689
- (b) 0.182
- (c) 5.33
- (d) 1.45

Q.45 A domain in a ferromagnetic substance is in the form of a cube of side $1\text{ }\mu\text{m}$. If it contains 8×10^{10} atoms and each atomic dipole has a dipole moment of $9 \times 10^{-24}\text{ A/m}^2$, then the magnetisation of the domain is:

- (a) $7.2 \times 10^9\text{ Am}^{-1}$
- (b) $7.2 \times 10^5\text{ Am}^{-1}$
- (c) $7.2 \times 10^{12}\text{ Am}^{-1}$
- (d) $7.2 \times 10^3\text{ Am}^{-1}$

Q.50 A bob of a simple pendulum has mass ' m ' and is oscillating with an amplitude ' a '. If the length of the pendulum is ' L ' then the maximum tension in the string is [$\cos 0^\circ = 1, g = \text{acceleration due to gravity}$]:

- (a) $mg \left[1 + \left(\frac{a}{L} \right)^2 \right]$
- (b) $mg \left[1 - \left(\frac{L}{a} \right)^2 \right]$
- (c) $mg \left[1 + \left(\frac{L}{a} \right)^2 \right]$
- (d) $mg \left[1 - \left(\frac{a}{L} \right)^2 \right]$

Q.16 A first order reaction is 25 % completed in 40 minutes. What is the rate constant k for the reaction?

- (a) $\frac{2.303 \times \log 1.33}{40}$
- (b) $2.303 \times \log \frac{4}{3}$
- (c) $\frac{2.303}{40} \times \log \frac{1}{4}$
- (d) $\frac{2.303 \times \log 4}{40 \times 3}$

Q.17 For first order reaction the concentration of reactant decreases from 0.2 to 0.1 M in 100 minutes. What is the rate constant of the reaction?

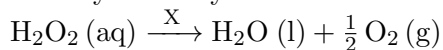
- (a) 6.93 min^{-1}
- (b) 69.3 min^{-1}

- (c) $6.93 \times 10^{-3} \text{ min}^{-1}$
- (d) 144.3 min^{-1}

Q.18 Which carbon atoms of α -D-glucopyranose and β -D-Fructofuranose respectively are linked together to form glycosidic linkage in sucrose?

- (a) C-2 of α -D-glucopyranose and C-3 of β -D-Fructofuranose
- (b) C-1 of α -D-glucopyranose and C-6 of β -D-Fructofuranose
- (c) C-2 of α -D-glucopyranose and C-2 of β -D-Fructofuranose
- (d) C-1 of α -D-glucopyranose and C-2 of β -D-Fructofuranose

Q.19 Identify the enzyme 'X' in the following reaction:



- (a) amylase
- (b) ferroxidase
- (c) Catalase
- (d) carbonic anhydrase

Q.20 Identify tranquilizer from the following?

- (a) Prontosil
- (b) Aspirin
- (c) Meprobamate
- (d) Salvarsan

Q.21 Which among the following is an ambidentate ligand?

- (a) NO_2^-
- (b) H_2O
- (c) NH_3
- (d) $\text{COO}^- - \text{COO}^-$

Q.22 Which of the following is correct decreasing order of the repulsive interaction of electron pairs in a molecule?

- (a) lone pair-lone pair > lone pair-bond pair > bond pair-bond pair
- (b) bond pair-bond pair = bond pair-lone pair > lone pair-lone pair
- (c) lone pair-bond pair > lone pair-lone pair > bond pair-bond pair
- (d) bond pair-bond pair > lone pair-bond pair > lone pair-lone pair

Q.23 If boiling point of urea solution is 100.18°C and k_b for water is $0.512 \text{ K kg mol}^{-1}$, molality of solution is? (Boiling point of water = 100°C)

- (a) 0.25 mol kg^{-1}
- (b) 0.6 mol kg^{-1}
- (c) 0.45 mol kg^{-1}
- (d) 0.35 mol kg^{-1}

Q.24 What is the unit of viscosity?

- (a) Kg s^{-1}
- (b) Nsm^{-2}
- (c) Kg s^2
- (d) Nm^{-1}

Q.25 Which of the following 0.10 m aqueous solutions will have maximum ΔT_f value?

- (a) $\text{Al}_2(\text{SO}_4)_3$
- (b) KI
- (c) $\text{C}_{12}\text{H}_{22}\text{O}_{11}$
- (d) $\text{NH}_2\text{--CO--NH}_2$

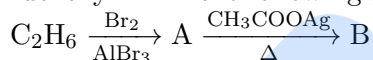
Q.26 Which of the following molecules has a central atom with complete octet?

- (a) Methane
- (b) Sulphur hexafluoride
- (c) Aluminium chloride
- (d) Boron trifluoride

Q.27 What is the percentage of unoccupied space in fcc unit cell?

- (a) 74 %
- (b) 26 %
- (c) 68 %
- (d) 32 %

Q.28 Identify 'B' in the following reaction:



- (a) $\text{CH}_3\text{COOC}_2\text{H}_5$
- (b) $\text{C}_2\text{H}_5\text{COOCH}_3$
- (c) $\text{CH}_3\text{COOCH}_3$
- (d) $\text{C}_2\text{H}_5\text{COOC}_2\text{H}_5$

Q.29 Which of the following molecular formula represents Marshall's acid?

- (a) H_2SO_5
- (b) $\text{H}_2\text{S}_2\text{O}_7$
- (c) $\text{H}_2\text{S}_2\text{O}_6$
- (d) $\text{H}_2\text{S}_2\text{O}_8$

Q.30 What is the formula of hydrolith?

- (a) MgH_2
- (b) CaH_2
- (c) BaH_2
- (d) BeH_2

Q.31 If A and B are supplementary angles, then $\sin^2 \frac{A}{2} + \sin^2 \frac{B}{2} =$:

- (a) 1
- (b) $1/3$
- (c) 0
- (d) $1/2$

Q.32 $\int_0^{\pi/2} \frac{\sqrt[7]{\sin x}}{\sqrt[7]{\sin x} + \sqrt[7]{\cos x}} dx =:$

- (a) $\pi/2$
- (b) $\pi/3$
- (c) $\pi/4$
- (d) $\pi/8$

Q.33 The cofactors of the elements of the first column of the matrix $A = \begin{bmatrix} 2 & 0 & -1 \\ 3 & 1 & 2 \\ -1 & 1 & 2 \end{bmatrix}$ are:

- (a) $0, -7, 2$
- (b) $0, -1, 1$
- (c) $0, -8, 4$
- (d) $-1, 3, -2$

Q.34 The quadratic equation whose roots are the numbers having arithmetic mean 34 and geometric mean 16 is:

- (a) $x^2 + 68x - 256 = 0$
- (b) $x^2 - 68x - 256 = 0$
- (c) $x^2 - 68x + 256 = 0$
- (d) $x^2 + 68x + 256 = 0$

Q.35 The area of the triangle ABC is $10\sqrt{3} \text{ cm}^2$, angle B is 60° and its perimeter is 20 cm, then $l(AC) =:$

- (a) 7 cm
- (b) 8 cm
- (c) 10 cm
- (d) 5 cm

Q.36 The equation of the line passing through $(1, 2, 3)$ and perpendicular to the lines $\frac{x-1}{2} = \frac{y+2}{4} = \frac{z+4}{4}$ and $\frac{x-1}{2} = \frac{y-2}{2} = z+3$ is:

- (a) $\frac{x-1}{6} = \frac{2-y}{7} = \frac{z-3}{2}$
- (b) $\frac{x-1}{6} = \frac{y-2}{7} = \frac{z-3}{2}$
- (c) $\frac{x-1}{4} = \frac{2-y}{5} = \frac{z-3}{2}$
- (d) $x-1 = \frac{y-2}{2} = \frac{z-3}{4}$

Q.37 If $R = \{(a, b) \mid b = a - 1, a \in \mathbb{Z}, 5 < a < 9\}$, then the range of R is:

- (a) $\{7, 8, 9\}$
- (b) $\{5, 6, 7\}$
- (c) $\{6, 7, 8\}$
- (d) $\{5, 6, 7, 8, 9\}$

Q.38 $\int \frac{dx}{x^2 + 4x + 13} =:$

- (a) $\frac{1}{3} \tan^{-1} \left(\frac{x+2}{3} \right) + c$
- (b) $\frac{1}{6} \log \left(\frac{x-1}{x+5} \right) + c$
- (c) $\frac{1}{6} \tan^{-1} \left(\frac{x+2}{3} \right) + c$
- (d) $3 \tan^{-1} \left(\frac{x+2}{3} \right) + c$

Q.39 If $A = \begin{bmatrix} 4 & 5 \\ 2 & 1 \end{bmatrix}$ and $A^2 - 5A - 6I = 0$, then $A^{-1} =:$

- (a) $\frac{1}{6} \begin{bmatrix} -1 & 5 \\ 2 & 4 \end{bmatrix}$
- (b) $\frac{1}{6} \begin{bmatrix} -1 & 5 \\ -2 & -4 \end{bmatrix}$
- (c) $\frac{1}{6} \begin{bmatrix} -1 & 5 \\ 2 & -4 \end{bmatrix}$
- (d) $\frac{1}{6} \begin{bmatrix} 1 & 5 \\ 2 & -4 \end{bmatrix}$

Q.40 The integrating factor of the differential equation $x \frac{dy}{dx} + y \log x = x^2$ is:

- (a) $(\log x)^x$
- (b) $x^{\log x}$
- (c) $(\log x)^2$
- (d) $x^{\log(\sqrt{x})}$

Q.41 The equations of planes parallel to the plane $x + 2y + 2z + 8 = 0$, which are at a distance of 2 units from the point $(1, 1, 2)$ are:

- (a) $x + 2y + 2z - 13 = 0$ or $x + 2y + 2z - 1 = 0$
- (b) $x + 2y + 2z - 6 = 0$ or $x + 2y + 2z - 7 = 0$
- (c) $x + 2y + 2z + 3 = 0$ or $x + 2y + 2z - 5 = 0$
- (d) $x + 2y + 2z - 5 = 0$ or $x + 2y + 2z - 3 = 0$