A Division of Aggarwal Educare
Aggarwal CLASSES™

# JEE (MAIN)

# TEST PAPER

***SUBJECT : PHYSICS,CHEMISTRY, MATHEMATICS*** ***TEST CODE : TSJMT219***

***QUESTION PAPER***

***TIME : 3 HRS*** ***MARKS : 300***

## INSTRUCTIONS

**GENERAL INSTRUCTIONS :**

1. This test consists of 75 questions.
2. There are three parts in the question paper A, B, C consisting of Physics, Chemistry and Mathematics having 25 questions in each part.
3. 20 questions will be Multiple choice questions & 5 quetions will have answer to be filled as numerical value.
4. Marking scheme :

| Type of Questions | Total Number of Questions | Correct Answer | Incorrect Answer | Unanswered |
|---|---|---|---|---|
| MCQ's | 20 | +4 | Minus One Mark(-1) | No Mark (0) |
| Numerical Values | 5 | +4 | No Mark (0) | No Mark (0) |

5. There is only one correct responce for each question. Filling up more than one responce in each question will be treated as wrong response and marks for wrong response will be deducted accordingly as per instruction 4 above.

**OPTICAL MARK RECOGNITION (OMR) :**

6. The OMR will be provided to the students.
7. Darken the appropriate bubbles on the OMR sheet by applying sufficient pressure.
8. The OMR sheet will be collected by the invigilator at the end of the examination.
9. Do not tamper with or mutilate the OMR. Do not use the OMR for rough work.
10. Write your name, Batch name, name of the center, Test Code, roll number and signature with pen in the space provided for this purpose on the OMR. Do not write any of these details anywhere else on the OMR.

**DARKENING THE BUBBLES ON THE OMR :**

11. Use a BLACK BALL POINT PEN to darken the bubbles on the OMR.
12. Darken the bubble COMPLETELY.
13. Darken the bubbles ONLY IF you are sure of the answer. There is NO WAY to erase or "un- darken" a darkened bubble.

# Part A - PHYSICS

Q.1 The potential energy of a 1-kg particle free to move along the $x$-axis is given by $U(x) = \left(\frac{x^4}{4} - \frac{x^2}{2}\right) J$. The total mechanical speed of the particle is 2 J. Then, the maximum speed (in m/s) is

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

Q.2 Statement-1 : Two particles moving in the same direction do not lose all their energy in a completely inelastic collision.
Statement-2 : Principle of conservation of momentum holds true for all kinds of collision.
(a) Statements-1 is true, Statements-2 is true; Statements-2 is correct explanation of Statements-1
(b) Statements-1 true, Statements-2 is true; Statements-2 is not the correct explantion of Statements-1
(c) Statements-1 is false, Statements-2 is true
(d) Statements-1 is true, Statements-2 is false.

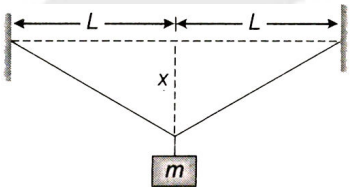
Q.3 A solid sphere rolls down in inclined plane and its velocity at the bottom is $v_1$. Then the same sphere slides down the plane (without friction) and let its velocity at the bottom be $v_2$. Which of the following relations is correct ?

(a) $v_1 = v_2$ (b) $v_1 = \frac{5}{7}v_2$ (c) $v_1 = \frac{7}{5}v_2$ (d) None of these

Q.4 A projectile is projected with velocity $kv_e$ in vertically upward direction from the ground into the space, ($v_e$ is the escape velocity and $\boldsymbol{k < 1}$). If air resistance is considered to be negligible, then the maximum height from the centre of Earth to which it can go will be ($R$ = radius of Earth)

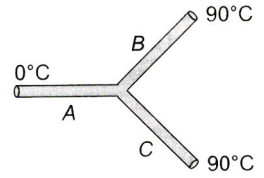
(a) $\frac{R}{k^2+1}$ (b) $\frac{R}{k^2-1}$ (c) $\frac{R}{1-k^2}$ (d) $\frac{R}{k+1}$

Q.5 A steel wire of diameter $d$, area of cross section $A$ and length 2L, is clamped firmly at two points $A$ and $B$ which are 2L meters apart and in the same plane. A body of mass $m$ is hung from the middle point of wire each that the middle point sags by $x$, lower from original position in figure, If Young's modulus is $Y$, then $m$ is given by




(a) $\frac{1}{2}\frac{YAx^2}{gL^2}$ (b) $\frac{1}{2}\frac{YAL^2}{gx^2}$ (c) $\frac{1}{2}\frac{YAx^3}{gL^3}$ (d) $\frac{1}{2}\frac{YAL^2}{gx^2}$

Q.6 Three rods made of the same material and having the same cross section have been joined as shown in figure. Each rod is of the same length. The left and right ends are kept at 0°C and 90°C, respectively. The temperature of the junction of the three rods will be



(a) 45°C (b) 60°C (c) 30°C (d) 20°C

Q.7 Certain amount of an ideal gas is contained in a closed vessel. The vessel is moving with a constant velocity $v$. The molecular mass of gas is M. The rise in temperature of the gas when the vessel is suddenly stopped is

(a) $\frac{Mv^2}{2R(\gamma+1)}$ (b) $\frac{Mv^2(\gamma-1)}{2R}$ (c) $\frac{mv^2}{2R(\gamma+1)}$ (d) $\frac{mv^2}{2R(\gamma+1)}$

Q.8 At 100°C, the volume of 1 kg of water is $10^{-3}$ m$^3$ and volume of 1 kg of steam at normal pressure is 1.671 m$^3$. The latent heat of steam is $2.3 \times 10^6$ j/kg and normal pressure is $10^5$ N/m$^2$. If 5 kg of water at 100°C is converted into steam, the increase in the internal energy of water in this process will be

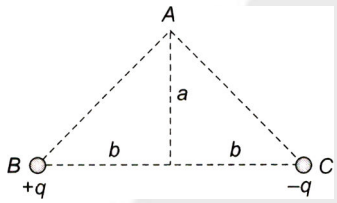
(a) $8.35 \times 10^5$ J (b) $10.66 \times 10^6$ J (c) $11.5 \times 10^6$ J (d) Zero

Q.9 A block is placed on a frictionless horizontal table. The mass of the block is $m$ and and springs of force constant $k_1$, $k_2$ are attached on either side of it, if the block is displaced a little and left to oscillate, then the angular frequency of oscillation will be

(a) $\left(\frac{k_1+k_2}{m}\right)^{1/2}$ (b) $\left[\frac{k_1k_2}{m(k_1+k_2)}\right]^{1/2}$ (c) $\left[\frac{k_1k_2}{(k_1-k_2)m}\right]^{1/2}$ (d) $\left[\frac{k_1^2+k_2^2}{(k_1+k_2)m}\right]^{1/2}$

Q.10 An electric dipole is placed at an angle of 30° to a non uniform electric field. The dipole will experience
(a) a translational force only in the direction of the field.
(b) a translational force only in direction normal to the direction of the field
(c) a torque as well as translational force
(d) a torque only.

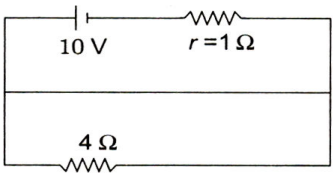
Q.11 As shown in figure, charges $+q$ and $-q$ are placed at the vertices $B$ and $C$ of aisosceles triangle. The potential at the vertex $A$ is




(a) $\frac{1}{4\pi\varepsilon_0}\cdot\frac{2q}{\sqrt{a^2+b^2}}$ (b) $\frac{1}{4\pi\varepsilon_0}\cdot\frac{q}{\sqrt{a^2+b^2}}$ (c) $\frac{1}{4\pi\varepsilon_0}\cdot\frac{(-q)}{\sqrt{a^2+b^2}}$ (d) Zero

Q.12 A sheet of aluminium foil of negligible thickness is introduced between the plates of a capacitor. The capacitances of the capacitor
(a) decreases (b) remains unchanged
(c) becomes infinite (d) increases

Q.13 The potential difference across the terminals of the bettery shown in figure, is ($r$ = internal resistance of battery)




(a) 8V (b) 10 V (c) 6 V (d) Zero

Q.14 An iron core shaped as a toroid with mean radius 250 mm, supports a winding with the total number of turns 1000. The core has a cross-cut of width 1.0 mm. With current $I = 0.85$ A flowing through the winding, the magnetic induction in the gap is 0.75 $T$, then the permeability of iron is :

(a) $2 \times 10^3$ (b) $0.3 \times 10^3$ (c) $3.7 \times 10^3$ (d) $10^3$

Q.15 In LCR ciruit $R = 100\ \Omega$. When capacitance C is removed, the current lags behind the voltage by $\pi/3$. When inductance L is removed, the current leads the voltage by $\pi/3$. The impedance of the circuit is

(a) $50\,\Omega$ (b) $100\,\Omega$ (c) $200\ \Omega$ (d) $400\,\Omega$

Q.16 In a region of free space the electric at field intensity some instant of time t is

$\vec{E} = (80\hat{i} + 32\hat{j} - 64\hat{k})$ and the magnetic field is $\vec{B} = (0.2\hat{i} + 0.08\hat{j} - 0.29\hat{k})\,\mu T$, The pointing vector for these fields is

(a) $-11.52\hat{i} + 28.8\hat{j}$ (b) $-28.8\hat{i} + 11.52\hat{j}$ (c) $28.8\hat{i} - 11.52\hat{j}$ (d) $11.52\hat{i} - 28.8\hat{j}$

Q.17 A man can see the objects upto a distance of one metre from his eyes. For correcting his eye sight so that he can see an object at infinity, he requires a lens whose power is

OR

A man can see upto 100 cm of the distant object. The power of the lens required to see for objects will be

(a) +0.5$D$ (b) +1.0$D$ (c) +2.0$D$ (d) -1.0$D$

Q.18 A particle of mass $M$ at rest decays into two masses $m_1$ and $m_2$ with non-zero velocities. The ratio $\lambda_1 / \lambda_2$ of de-Broglie wavelengths of the particles is

(a) $\frac{m_2}{m_1}$ (b) $\frac{m_1}{m_2}$ (c) $\frac{\sqrt{m_1}}{\sqrt{m_2}}$ (d) 1 : 1

Q.19 An atom makes a transition from a state of energy $E_2$ to one of lower energy $E_1$. Which of the following gives the wavelenegth of the radiation emitted in terms of the Planck's constants $h$ and the speed of light c ?

(a) $\frac{E_2 - E_1}{hc}$ (b) $\frac{hc}{E_2} - \frac{hc}{E_2}$ (c) $\frac{hc}{E_1} - \frac{hc}{E_2}$ (d) $\frac{hc}{E_2 - E_1}$

Q.20 A step index fiber has relative refractive index of 0.88%. What is the critical angle at the corecladding interface ?

(a) 60° (b) 75° (c) 45° (d) None of these

Q.21 Two full turns of the circular scale of a screw gauge cover a distance of divisions on the circular scale is 50. Further, it is found that the screw gauge has a zero error of -0.03 mm. While measuring the diameter of a thin wire, a students notes tha main scale reading of 3 mm and the number of circular scale divisions in the line with the main scale as 35. The diameter of the wire is_____?

Q.22 A mixture of light, consisting of wavelength 590 nm and an unknown wavelength, illuminates Young's double slit and gives rise to two overlapping interference patterns on the screen. The central maximum of both lights coincide. Further, it is observed that the third bright fringe of known light coincide with fourth bright fringe of unknown light. From this data, the wavelength of the unknown light is _____?

Q.23 A boat is moving due east in a region where Earth's magnetic field is $5.0 \times 10^{-5}$ NA/m due north and horizontal. The boat carries a vertical aerial 2 m long. If the speed of the boat is 1.50 m/s, the magnetic of the induced emf in the wire of aerial is_____?

Q.24 A motor cycle starts from rest and accelerates along a straight path at 2 m/s$^2$. At the starting point of the motor cycle there is a stationary electric siren. How far has the motor cycle gone when the driver hears the frequency of the siren at 94% of its value when the motor cycle was at rest ? (speed of sound = 330 m/s).

Q.25 Two bulbs of 100 W and 200 W, rated at 220 V are connected in series. On supplying 220 V, the consumption of power will be ?

# Part - B - CHEMISTRY

Q.26 In the mixture of ($NaHCO_3$ + $Na_2CO_3$), the volume of HCl required is $x$ mL with phenolphthalein indicator and $y$ mL with methyl orange indicator in the same titration. Hence, the volume of HCl for complete reaction of $Na_2CO_3$ is :

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

Q.27 If wavelength is equal to the distance traveled by the electron in one second then :

(a) $\lambda = \frac{h}{p}$ (b) $\lambda = \frac{h}{m}$ (c) $\lambda = \sqrt{\frac{h}{p}}$ (d) $\lambda = \sqrt{\frac{h}{m}}$

Q.28 $N_2$ and $O_2$ are converted into monocation $N_2^+$ and $O_2^+$ respectively. Which of the following statements is wrong ?

(a) In $N_2$, then $N-N$ bond weakness (b) In $O_2$, the $O-O$ bond order increase

(c) In $O_2$, paramagnetism decrease (d) $N_2^+$ becomes diamagnetic

Q.29 If some moles of $O_2$ diffuse in 18 s and same moles of other gas diffuse in 45 s, then what is the molecular weight of the unknown gas ?

(a) $\frac{45^2}{18^2} \times 32$ (b) $\frac{18^2}{45^2} \times 32$ (c) $\frac{18^2}{45^2 \times 32}$ (d) $\frac{45^2}{18^2 \times 32}$

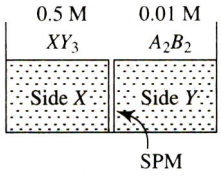
Q.30 In the dissociation of $PCl_5$ ; $PCl_{5(g)} \rightleftarrows PCl_{3(g)} + Cl_{2(g)}$, If the degree of dissocitation is $\alpha$ at equilibrium pressure P, then the equilibrium constant for the reaction is :

(a) $K_p = \frac{\alpha^2}{1+\alpha^2 P}$ (b) $K_p = \frac{\alpha^2 P^2}{1-\alpha^2}$ (c) $K_p = \frac{\alpha P^2}{1-\alpha^2}$ (d) $K_p = \frac{\alpha^2 P}{1-\alpha^2}$

Q.31 If p$K_b$ for fluoride ion at 25°C is 10.83, the ionization constant of hydrofluoric acid in water at this temperature is :

(a) $1.74 \times 10^{-3}$ (b) $3.52 \times 10^{-3}$ (c) $6.75 \times 10^{-4}$ (d) $5.38 \times 10^{-2}$

Q.32 $X_3Y_2$ $(i = 5)$ when reacted with $A_2B_3$ $(i = 5)$ in aqueous solution gives brown color. These are separated by a semipermeable membrane AB as shown in the adajcent figure. Due to osmosis, there is :



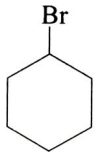
(a) brown color formation in side X
(b) brown color formation in side Y
(c) brown color formation in both sof the side X and Y
(d) no brown color formation

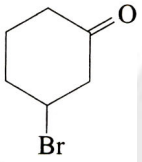
Q.33 The reaction $[Co(NH_3)_5Br]^{2+} + H_2O \rightarrow [Co(NH_3)_5(H_2O)]^{3+} + Br^-$ is followed by measuring a property of the solution known as the optical density of the solution which may be taken to be linearly related to the concentration of the reactant. The values of optical density are0.80, 0.35 and 0.20 at the end of 20 min, 40 min, and infinite time the start of the reaction which is first order. Calculate the rate constant

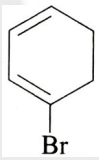
(a) $6.93 \times 10^{-3}\ min^{-1}$ (b) $3.51 \times 10^{-2}\ min^{-1}$

(c) $6.93 \times 10^{-2}\ min^{-1}$ (d) $3.51 \times 10^{-3}\ min^{-1}$

Q.34 Which of the following compounds has asymmertic centre ?

(a) 

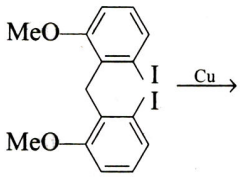

(b) 

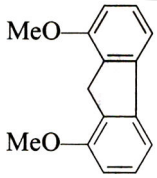

(c) 

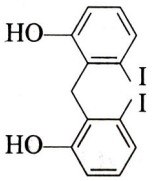

(d) Both (b) and (c)

Q.35 Select the incorrect statement :
(a) Bromine is more selective and less reactive
(b) Chlorine is less selective and more reactive
(c) Benzyl free radical is more stable than 2° free radical
(d) Vinyl free radical more stable than allyl free radical

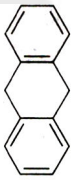
Q.36 What would be the major product of the given reaction ?




(a) 


(b) 


(c) 

(d) 

Q.37 When a mixture of ethanol and methanol is heated in the presence of concentrated $H_2SO_4$, the resulting organic product(s) is /are :
(a) $CH_3OC_2H_5$ (b) $CH_3OCH_3$ and $C_2H_5OC_2H_5$
(c) $CH_3OC_2H_5$ and $CH_3OCH_3$ (d) $CH_3OC_2H_5$, $CH_3OCH_3$, and $C_2H_5OC_2H_5$

Q.38 Compound (A), $C_9H_{10}O$, is inert to $Br_2$ in $CCl_4$. Vigorous oxidation with hot alkanline $KMnO_4$ yields benzoic acid. (A) gives red precipitates with 1, 4-dinitrophenylhydrazine and yellow with NaOl. The possible structure of compound (A) will be :
(a) $PhCOCH_2CH_3$ (b) $PhCH_2COCH_3$ (c) $PhCH_2CH_2CHO$ (d) $PhCH(CH_3)CHO$

Q.39 Zone refining is a technique used primarily for which one of the following process ?
(a) Alloying (b) Tempering (c) Sintering (d) Purification

Q.40 Out of all the known elements, the percentage of transitional elements is approximately :
(a) 30% (b) 50% (c) 60% (d) 75%

Q.41 Molecular weight of an organic acid is given by :

(a) Equivalent weight × Basicity (b) $\frac{\text{Equivalent weight}}{\text{Basicity}}$

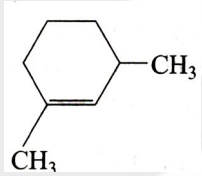
(c) $\frac{\text{Basicity}}{\text{Equivalent weight}}$ (d) Equivalent weight × Valency

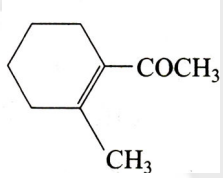
Q.42 Chargaff's rule states that in an organism :
(a) amount of all bases are equal
(b) amount of adenine (A) is equal to that of thymine (T) and the amount of guanine (G) is equal to that of cytosine (C)
(c) amount of adenine (A) is equal to that of guanine (G) and the amount of thymine (T) is equal to that of cytosine (C)
(d) amount of adenine (A) is equal to that of cytosine (C) and the amount of thymine (T) is equal to guanine (G)

Q.43 The enthalpy change for a given reaction at 298 K is -*x* J/mol (*x* being positive). If the reaction occurs spontaneously at 298 K, the entropy change at the temperature :
(a) can be negative but numerically larger than *x*/298
(b) can be negative but numerically smaller than *x*/298
(c) can be negative
(d) cannot be positive

Q.44 The ability of an ion to bring about coagulation of a given colloid depends on :
(a) its size
(b) the magnetic of its charge only
(c) the sign of its charge
(d) both the magnitude and the sign of tis charge

Q.45 In which of the following molecules all the effects namely inductive, mesomeric, and hyperconjugation operate ?

(a)  (b) 

(c) 

(d)  *

Q.46 Calculate the electrode potential at 25°C of $Cr^{3+}$, $Cr_2O_7^{2-}$ electrode at pOH = 11in a solution of 0.01 M of both $Cr^{3+}$ and $Cr_2O_7^{2-}$ in solution $E^o$, value for the cell.

Q.47 A 0.500 g sample of magnetite ore (impure $Fe_3O_4$) is treated so thet he iron is precipitate as Fe-*111* hydroxide. The precipitate is heated and converted to 0.4980 g $Fe_2O_3$. What is the percentage $Fe_3O_4$ in the ore ?

Q.48 Electromagnetic radiations of wavelength 242 nm are just sufficient to ionize sodium atom. Then the ionization energy of sodium in kJ/mol is:

Q.49 $NH_3$ is produced according to the following reaction :

$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$

In an experiment 0.25 mol of $NH_3$ is formed when 0.5 mol of $N_2$ is reacted with 0.5 mol of $H_2$. What is % yield ?

Q.50 Naturally occurring thallium consists of two stable isotopes, Tl-203 and Tl-205 (atomic mass = 203.0 and 205.0 respectivaly) and has an average atomic mass of 204.4 what is percentage of Tl -205 ?

# Part - C - MATHEMATICS

Q.51 Let $O(0, 0)$, $P(3, 4)$ and $Q(6, 0)$ be the vertices of the triangle $OPQ$. The point R insides the triangle $OPQ$ is such that the triangle $OPQ$, $PQR$, and $OQR$ are of equal area. The coordinates of $R$ are

(a) $\left(\frac{4}{3}, 3\right)$ (b) $\left(3, \frac{2}{3}\right)$ (c) $\left(3, \frac{4}{3}\right)$ (d) $\left(\frac{4}{3}, \frac{2}{3}\right)$

Q.52 On the ellips $4x^2 + 9y^2 = 1$, point at which the tangent are parallel to the line $8x = 9y$ are

(a) $\left(\frac{2}{5}, \frac{1}{5}\right)$ (b) $\left(-\frac{2}{5}, \frac{1}{5}\right)$ (c) $\left(-\frac{2}{5}, -\frac{1}{5}\right)$ (d) none of these

Q.53 $y = x + 2$ is any tangent to the parabola $y^2 = 8x$. The point $P$ on this tangent such that the other tangent from it which is perpendicular to it is

(a) (2, 4) (b) (-2, 0) (c) (-1, 1) (d) (2, 0)

Q.54 Consider the of $y = Ax^2$ and $y^2 + 3 = x^2 + 4y$, where A is a positive constant and $x, y \in R$. Number of points in which tht two graph intersect is

(a) exactly 4
(b) exactly 2
(c) at least 2 but the number of points varies for different positive values of A
(d) zero for at least one positive A

Q.55 If $f: R \to R$ satisfies $f(x + y) = f(x) + f(y)$ all $x, y \in R$ and $f(1) = 7$ Then $\sum_{r=1}^{n} f(r)$ is

(a) $\frac{7(n+1)}{2}$ (b) $7n(n+1)$ (c) $\frac{7n(n+1)}{2}$ (d) $\frac{7n}{2}$

Q.56 Which of the following is not true about the function $f(x) = \begin{cases} 5x - 4 & \text{for } 0 < x \le 1 \\ 4x^2 - 3x & \text{for } 1 < x < 2 \\ 3x + 4 & \text{for } x \ge 2 \end{cases}$

(a) continuous at $x = 2$ and $x = 2$
(b) continuous at $x = 1$ but not derivable at $x = 2$
(c) continuous at $x = 2$ bu not derivable at $x = 2$
(d) none of these

Q.57 If $x = \log p$ and $y = \frac{1}{p}$, then

(a) $\frac{d^2y}{dx^2} - 2p = 0$ (b) $\frac{d^2y}{dx^2} + y = 0$

(c) $\frac{d^2y}{dx^2} + \frac{dy}{dx} = 0$ (d) $\frac{d^2y}{dx^2} - \frac{dy}{dx} = 0$

Q.58 If $f(x) = \frac{x}{\sin x}$ and $g(x) = \frac{x}{\tan x}$, where $0 < x \le 1$. then in this interval

(a) both $f(x)$ and $g(x)$ are increasing function

(b) both $f(x)$ and $g(x)$ are decreasing function

(c) $f(x)$ is an increasing function

(d) $g(x)$ is an increasing function

Q.59 The integral $\frac{dx}{(1+\sin x)^{1/2}}$ is

(a) $\sqrt{2}\log\left|\cot\frac{3\pi}{8}-\frac{\pi}{4}\right|+c$

(b) $\sqrt{2}\log\left|\text{cosec}\left(\frac{\pi}{4}+\frac{x}{2}\right)-\cot\left(\frac{\pi}{4}+\frac{x}{2}\right)\right|+c$

(c) $\sqrt{2}\log\left|\tan\left(\frac{\pi}{8}+\frac{\pi}{4}\right)\right|+c$

(d) $\sqrt{2}\log\left|\sec\left(\frac{\pi}{4}-\frac{x}{2}\right)+\tan\left(\frac{\pi}{4}-\frac{\pi}{2}\right)\right|+c$

Q.60 Let $I=\int_0^1\frac{\sin x}{\sqrt{x}}dx$ and $J=\int_0^1\frac{\cos x}{\sqrt{x}}dx$. then which one of the following is true ?

(a) $I>\frac{2}{3}$ and $J>2$

(b) $I<\frac{2}{3}$ and $J<2$

(c) $I<\frac{2}{3}$ and $J>2$

(d) $I>\frac{2}{3}$ and $J<2$

Q.61 The differential equation of the family of curves $y=e^x(A\cos x+B\sin x)$, where $A$ and $B$ are arbitrary costants, is

(a) $\frac{d^2y}{dx^2}-2\frac{dy}{dx}+2y=0$

(b) $\frac{d^2y}{dx^2}+2\frac{dy}{dx}-2y=0$

(c) $\frac{d^2y}{dx^2}+\left(\frac{dy}{dx}\right)^2+y=0$

(d) $\frac{d^2y}{dx^2}-7\frac{dy}{dx}+2y=0$

Q.62 If $\frac{\sin x}{\sin y}=\frac{1}{2}$, $\frac{\cos x}{\cos y}=\frac{3}{2}$ where $x,y\in\left(0,\frac{\pi}{2}\right)$ then the value of $\tan(x+y)$ is equal to

(a) $\sqrt{13}$ (b) $\sqrt{14}$ (c) $\sqrt{17}$ (d) $\sqrt{15}$

Q.63 In a triangle ABC, $a$, $b$, $c$ are the lengths of its sides and $A$, $B$, $C$ are in the angles of triangle $ABC$. The correct relation is given by

(a) $(b-c)\sin\left(\frac{B-C}{2}\right)=a\cos\frac{A}{2}$

(b) $(b-c)\cos\left(\frac{A}{2}\right)=a\sin\frac{B-C}{2}$

(c) $(b-c)\cos\left(\frac{A}{2}\right)=a\sin\frac{B-C}{2}$

(d) $(b-c)\cos\left(\frac{A}{2}\right)=2a\sin\frac{B+C}{2}$

Q.64 A man from the top of a 100 m high tower sees a car moving towards the tower at an angle of depression of 30°. After some time, the angle of depression becomes 60°. The distance (in meters) travelled by the car daily this time is

(a) $100\sqrt{3}$ (b) $(200\sqrt{3})/3$ (c) $(100\sqrt{3})/3$ (d) $200\sqrt{3}$

Q.65 $\vec{a} = \hat{i} + \hat{j} + \hat{k}$ and $\vec{b} = \hat{i} - 2\hat{j} + \hat{k}$, then the vector $\vec{c}$ such that $\vec{a} \cdot \vec{c} = 2$ and $\vec{a} \times \vec{c} = \vec{b}$ is

(a) $\frac{1}{3}(\hat{i} - 2\hat{j} + \hat{k})$ (b) $\frac{1}{3}(-\hat{i} + 2\hat{j} + 5\hat{k})$ (c) $\frac{1}{3}(\hat{i} + 2\hat{j} - 5\hat{k})$ (d) $\frac{1}{3}(-\hat{i} + 2\hat{j} - 5\hat{k})$

Q.66 Two system of rectangular axes have the same origin. If a plane cuts, then at distance $a$, $b$, $c$ and $a'$, $b'$, $c'$ from the origin, then

(a) $\frac{1}{a^2} + \frac{1}{b^2} + \frac{1}{c^2} + \frac{1}{a'^2} + \frac{1}{b'^2} + \frac{1}{c'^2} = 0$ (b) $\frac{1}{a^2} - \frac{1}{b^2} - \frac{1}{c^2} + \frac{1}{a'^2} - \frac{1}{b'^2} - \frac{1}{c'^2} = 0$

(c) $\frac{1}{a^2} + \frac{1}{b^2} + \frac{1}{c^2} - \frac{1}{a'^2} - \frac{1}{b'^2} - \frac{1}{c'^2} = 0$ (d) $\frac{1}{a^2} + \frac{1}{b^2} + \frac{1}{c^2} - \frac{1}{a'^2} + \frac{1}{b'^2} + \frac{1}{c'^2} = 0$

Q.67 At a telephone enquiry system the number of phone calls regarding relevent enquiry follow Poisson distribution with an average of 5 phone cells during 10-minute time intervals. The probability that there is at the most one phone call during a 10-minutes time period is

(a) $\frac{6}{5}$ (b) $\frac{5}{6}$ (c) $\frac{6}{55}$ (d) $\frac{6}{e^5}s$

Q.68 The following data is given the distribution of height of students

| Height (in cm) | 160 | 150 | 152 | 161 | 156 | 154 | 155 |
|---|---|---|---|---|---|---|---|
| Number of studunts | 12 | 8 | 4 | 4 | 3 | 3 | 7 |

The median of the distribution is

(a) 154 (b) 155 (c) 160 (d) 161

Q.69 If each of the following statements it true, then $p \Rightarrow -q$; $q \Rightarrow r$; $-r$

(a) $p$ is false (b) $p$ is true (c) $q$ is true (d) none of these

Q.70 $(p \wedge \sim q) \wedge (\sim p \wedge q)$ is

(a) a tautology (b) a contraction

(c) tautology and contradiction (d) neither a tautology nor a contradiction

Q.71 A survey shows that 63% of the Indian like cheese whereas 76% like apples. If $x$% of the Indian like both cheese and apples, then $x$ can be ?

(a) 40 (b) 65 (c) 39 (d) none of these

Q.72 In a 12-storey building three persons enter a lift cabin, It is known that they will leave the lift at different storeys. In how many ways can they do so if the lift does not stop at the second storey ?

Q.73 $f(x) = \frac{3x^2 + ax + a + 1}{x^2 + x - 2}$ and $\lim_{x \to -2} f(x)$ exists, then the value of $a$ is _____?

Q.74 Let $f(x)$ be a continuous function defined for $1 \le x \le 3$. If $f(x)$ takes rational values for all x and $f(2) = 10$ then the value of $f(1.5)$ is _____?

Q.75 If $\int e^x \sin 2x \; dx$, then for what value of K, $KI = e^x(\sin 2x - 2\cos 2x) +$ constant?

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## ROUGH WORK

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