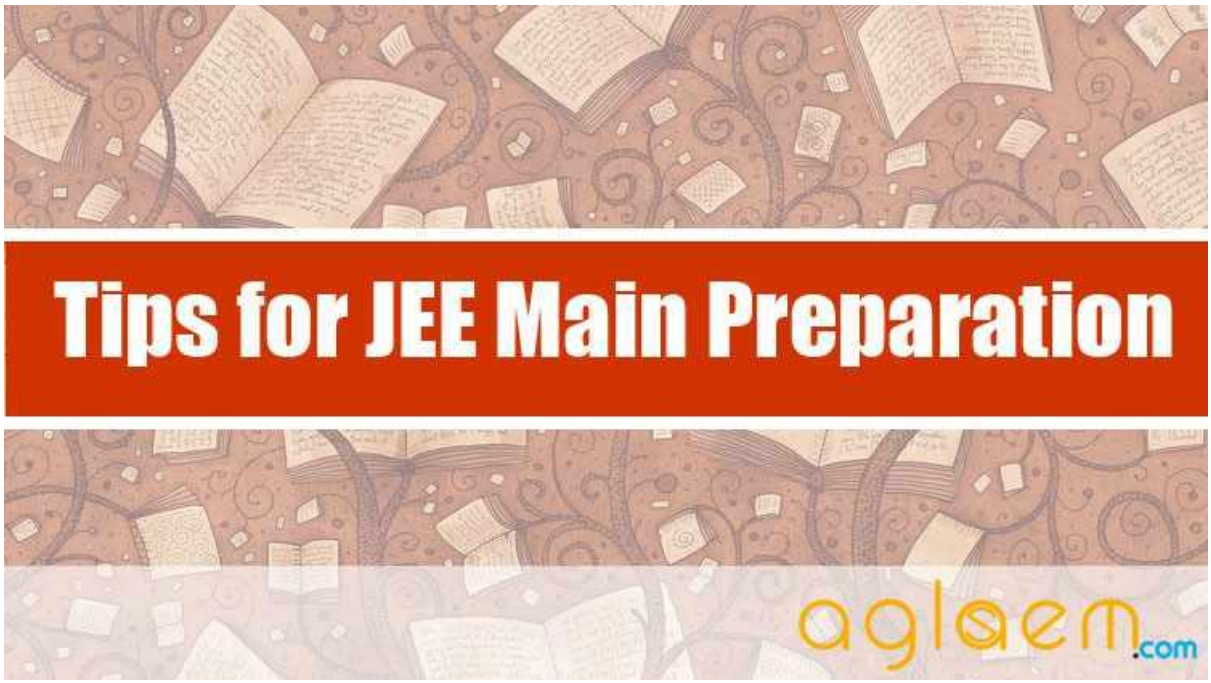
JEE Main

Sample Paper 1



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PHYSICS

Q1. Ten litre of water per second is lifted from well through 20 m and delivered with a velocity of 10m/s, then the power of the motor is:

a. 1.5 kW

b. 2.5 kW

c. 3.5 kW

d. 4.5 kW

Q2. A ring of mass m and radius R is pivoted at a point O on its periphery. It is free to rotate about an axis perpendicular to its plane. What is the period of ring?

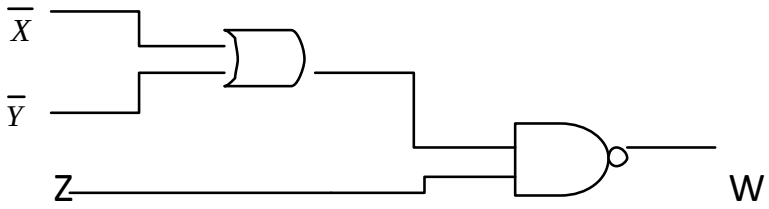
a. $T = 2\pi\sqrt{\left(\frac{R}{g}\right)}$

b. $T = 2\pi\sqrt{\left(\frac{2R}{g}\right)}$

c. $T = \pi\sqrt{\left(\frac{2R}{g}\right)}$

d. $T = 2\pi\sqrt{\left(\frac{3R}{g}\right)}$

Q3. Output W is given by :



a)(X-Y)Z

b)(X+Y)Z

c) $\overline{X}.\overline{Y}$ + z

d) $(\overline{X}.\overline{Y})$.z

Q4. A car is moving rectilinearly on a horizontal path with acceleration α_0. A person sitting inside the car observes that an insect S is crawling up the screen with an acceleration α. If θ is the inclination of the screen with the horizontal, acceleration of the insect:

a. Parallel to the screen is $\alpha + \alpha_0 \cos\theta$

b. Along the horizontal is $\alpha_0 + \alpha \cos\theta$

c. Perpendicular to the screen is $\alpha_0 \sin\theta$

d. Perpendicular to the screen is $\alpha_0 \tan\theta$

Q5. Bernoulli's equation is applicable to points:

a. In a steadily flowing liquid

b. In a stream line

c. In a straight line perpendicular to a stream line

d. In any viscous liquid.

Q6. If v_s, v_x and v_m are the speeds of gamma rays ,X-rays and microwaves respectively in the vacuum then :

a)$v_s > v_x > v_m$

b)$v_s < v_x < v_m$

c)$v_s > v_x < v_m$

d)$v_s = v_x = v_m$

Q7. If the angular momentum of a body increases by 40% its kinetic energy of rotation increases by:

a. 80%

b. 20%

c. 96%

d. None of these

Q8. When two coherent monochromatic light beams of intensities I and 4I are superimposed, what are the maximum and minimum possible intensities in the resulting beams?

a) 9I and I

b) 9I and 3I

c) 5I and I

d) 9I and 3I

Q9. A sphere and a cube of same material and same total surface area are placed in the same evacuated space turn by turn, after they are heated to the same temperature. Let initial rate of cooling of the sphere and cube are R_1 and R_2 respectively, then compare its initial rate of cooling:

a) $R_1 > R_2$

b) $R_1 < R_2$

c) $R_1 = R_2$

d) none of these

Q10. The intensity of gamma radiations from a given source is I .On passing through 36 mm of lead, it is reduced to I /8.
The thickness of lead, which will reduce the intensity to I /2 will be:

a)6 mm

b)9 mm

c)18 mm

d)12 mm

Q11. A man first moves 3m due east, then 6m due north, and finally 7m due west, then the magnitude of the resultant displacement is:

a. √16

b. √24

c. √52

d. √94

Q12. A current of 1.5 A flows through a copper voltammeter. The thickness of copper deposited on the electrode surface of area 50 cm^2 in 20 min is:

(Density of Cu = 9000 kg/m^{-3}; ECE of Cu = 3.3 x 10^{-7} kgc^{-1})

a. 1.3 x 10^{-4} m

b. 1.3 x 10^{-5} m

c. 2.6 x 10^{-4} m

d. 2.6 x 10^{-5} m

Q13. There is a road between two parallel rows of buildings and distance between the rows of buildings is 106m. The velocity of car if a car blows a horn whose echo is heard by the driver after 1s is: (Speed of sound = 340 m/s)

a. 180 m/s

b. 165 m/s

c. 323 m/s

d. 150 m/s

Q14. A long solenoid has 200 turns per cm and carries a current i. The magnetic field is at its center is 6.28 x 10^{-2} Wb/m^2.Another

long solenoid is 100 turns per cm and its carries a current i/3. The value of the magnetic field at its centre is :

a) 1.05×10^{-2} Wb/m^2

b) 1.05×10^{-5} Wb/m^2

c) 1.05×10^{-3} Wb/m^2

d) 1.05×10^{-4} Wb/m^2

Q15. A stone of mass 1 kg is tied to a string 4m long and is rotated at constant speed of 40 m/s in a vertical circle. The ratio of the tension at the top and the bottom is: (g = 10 m/s^2)

a. 11 : 12

b. 39 : 41

c. 41 : 39

d. 12 : 11

Q16. A wire is elongated by 2mm when a brick is suspended from it. When the brick is immersed in water, the wire contracts by 0.6mm. What is the density of the brick? (Density of water = 1000 kg/m^3)

a. 3333 kg/m^3

b. 4210 kg/m^3

c. 5000 kg/m^3

d. 2000 kg/m^3

Q17. The escape velocity of a body on the surface of the earth is 11.2 km/s. If the earth's mass increases to twice its present value and radius of the earth becomes half, the escape velocity becomes:

a. 5.6 km/s

b. 11.2 km/s

c. 22.4 km/s

d. 44.8 km/s

Q18. The time taken by a photoelectron to come out after the photon strikes is approximately:

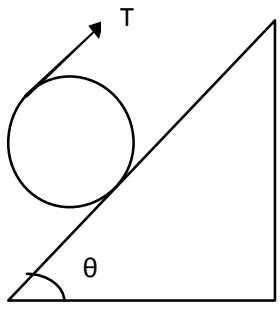
a) 10^{-4} s

b) 10^{-10} s

c) 10^{-16} s

d) 10^{-1} s

Q19. A heavy circular disc whose plane is vertical is kept at rest on rough inclined plane by a string parallel to the plane and touching the circle (shown in the figure). Disc starts to slip if:



a. $\mu < \frac{1}{2}\tan\alpha$

b. $\mu > \frac{1}{2}\tan\alpha$

c. $\mu < \tan \alpha$

d. $\mu < \frac{1}{4} \tan \alpha$

Q20. If $F = 6\pi \eta^a r^b v^c$,

where, F = viscous force

η = coefficient of viscosity

r = radius of spherical body

v = terminal velocity of the body

Find the values of *a, b* and *c*.

a. a = 1, b =2, c = 1

b. a = 1, b = 1, c = 1

c. a = 2, b = 1, c = 1

d. a = 2, b = 1, c = 2

Q21. A common–base mode of transistor, the collector current is 5.488 mA for an amplification factor (β) will be :

a) 49

b) 50

c) 51

d) 48

Q22. The radius of hydrogen atom in ground state is 5×10^{-11} m.The radius of hydrogen atom in Fermi metre is :

(1 fm = 10^{-15} m)

a) 5×10^{4} fm

b) 2×10^{4} fm

c) 5×10^{2} fm

d) 5×10^{6} fm

Q23. A small bar magnet ring is placed on the axis of a small conducting ring of radius r. The ring is pushed towards the dipole at a speed v that is kept constant. When the dipole-ring separation is x:

a) the induced current in the loop varies as x^{-8}

b) the magnetic flux through the loop varies as x^{-8}

c) the force on the ring due to magnetic dipole varies as x^{-8}

d) the magnetic moment of the ring due to the magnetic dipole varies as x^{-4}

Q24. A block of mass 100g slides on a rough horizontal surface. If the speed of the block decreases from 10 m/s to 5 m/s, the thermal energy developed in the process is:

a))3.75 J

b)37.5 J

c)0.375J

d)0.75 J

Q25. Needles N_1, N_2 and N_3 are made of ferromagnetic, a paramagnetic and a diamagnetic substance respectively. A magnet when brought close to then will :

a) Attract N_1 and N_2 strongly but repel N_3

b) Attract N_1 strongly, N_2 weakly and repel N_3 weakly

c) Attract N_1 strongly but repel N_2 and N_3 weakly

d) Attract all three of them

Q26. A thin glass (refractive index 1.5) lens has optical power of -5D in air . Its optical power in a liquid medium with refractive index 1.6 will be :

a) 1D

b) -1D

c) 25D

d) -25D

Q27. An automobile travelling with a speed of 60km/h, can brake to stop within a distance of 20m. If the car is going twice as fast, i.e. 120 km/h, the stopping distance will be:

a. 20 m

b. 40 m

c. 60 m

d. 80 m

Q28. Two spherical conductor A and B of radii 1 mm and 2 mm are separated by a distance for 5 cm and are uniformly charged . if the spheres are connected , the ratio of the magnitude of the electric fields at the surface of the spheres A and B is:

a)4 :1

b)1:2

c)2:1

d)1:4

Q29. A point moves in the x-y plane according to the law x = a sin ωt , y= a(1-cos ωt), where a and ω are positive constants. The distance s traversed by the point during the time τ :

a) $\frac{a\omega^2}{\tau}$

b) $a\omega^2\tau$

c) $a\omega\tau$

d) $\frac{a\omega}{\tau}$

Q30. A body is dropped and observed to bounce a height greater than the dropping height. Then:

a. The collision is elastic.

b. There is additional source of energy during collision

c. It is not possible

d. This type of phenomenon does not occur in nature.

CHEMISTRY:

Q31. A gas behaves like an ideal gas at:

a. High pressure and low temperature

b. Low pressure and high temperature

c. High pressure and high temperature

d. Low pressure and low temperature

Q32. Which of the following will have effective magnetic momentum equal?

a. Ti^{2+} and V^{2-}

b. Cr^{2+} and Fe^{2+}

c. Cr^{3+} and Mn^{2+}

d. V^{2+} and Sc^{3+}

Q33. Which one of the following objects is achiral?

a. Letter F

b. Letter P

c. Ball

d. A pair of hands

Q34. Diborane is a potential rocket fuel which undergoes combustion according to the equation:

$B_2H_6(g) + 3O_2(g) \rightarrow B_2O_3(g) + 3\,H_2O(g)$

Calculate the enthalpy change for the combustion of diborane. Given:

i. $2B(s) + \frac{3}{2}O_2 \rightarrow B_2O_3(s)$; $\Delta H = -1273$ kJ per mol

ii. $H_2(g) + \frac{1}{2}O_2 \rightarrow H_2O(l)$; $\Delta H = -286$ kJ per mol

iii. $H_2O(l) \rightarrow H_2O(g)$; $\Delta H = 44$ kJ per mol

iv. $2B(s) + 3H_2(g) \rightarrow B_2H_6(g)$; $\Delta H = 36$ kJ per mol

a. +2035 kJ per mol

b. – 2035 kJ per mol

c. + 2167 kJ per mol

d. – 2167 kJ per mol

Q35. Carbon tetrachloride does not have a dipole moment due to:

a. Its regular tetrahedral structure

b. Its planar structure

c. The similar electron affinities of carbon and chlorine

d. The similar size of the carbon and chlorine atoms

Q36. Correct order of reducing power of the following carbonyl compounds:

a. $HCHO > CH_3COCH_3 > \text{ø}CHO$

b. $CH_3COCH_3 > \text{ø}CHO > HCHO$

c. $HCHO > \text{ø}CHO > CH_3COCH_3$

d. $CH_3COCH_3 > HCHO > \text{ø}CHO$

Q37. Permanent hardness of water can be removed by adding:

a. Sodium chloride

b. Sodium carbonate

c. Washing soda

d. Soda lime

Q38. The electric conduction of a salt solution in water depends on the:

a. Size of its molecules

b. Shape of its molecules

c. Size of solvent molecules

d. Extent of its ionization.

Q39. The correct statement related to IUPAC nomenclature is:

a. If 2 or more chains of equal length are seen in the compound then the chain with minimum number of side chains is preferred.

b. If double and triple bonds are at symmetrical positions in a compound then triple bond gets lower preference

c. Correct IUPAC name of $CH_3COC_2H_5$ is ethyl methyl ketone

d. As far as possible, the IUPAC name of a compound is written as a single word.

Q40. Choose the incorrect statement:

a. The shape of an orbital depends upon the azimuthal quantum number.

b. The orientation of an atomic orbital depends upon the magnetic quantum number.

c. The energy of an electron in an atomic orbital of multi-electron atom depends on principal quantum number.

d. The number of degenerate atomic orbitals of one type depends on the value of azimuthal and magnetic quantum numbers.

Q41. Calculate the free energy change of:

$2CuO(s) \longrightarrow Cu_2O(s) + \frac{1}{2} O_2(g)$

Given $\Delta H = 145.6$kJ per mol

$\Delta S = 116$J per mol per K

a. 110.8 kJ per mol

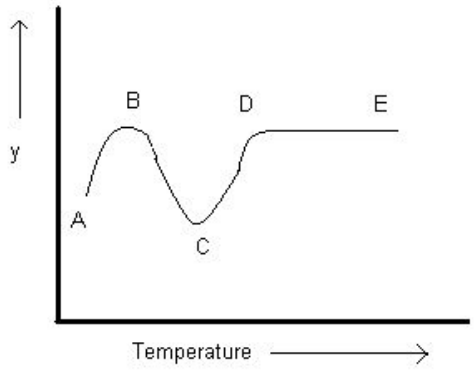
b. 221.5 kJ per mol

c. 55.4 kJ per mol

d. 145.6 kJ per mol

Q42. Formation of Y from X is given in the graph shown below:

From the graph it can be concluded that:



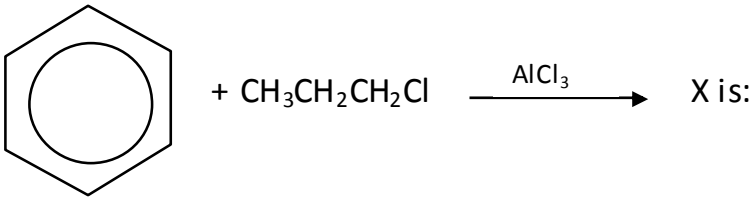
a. Reaction A to B is endothermic

b. Reaction A to B along with C to D is exothermic

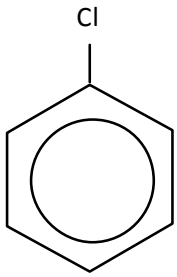
c. Reaction is exothermic from B to C

d. $\Delta H = 0$ for the stage D to E.

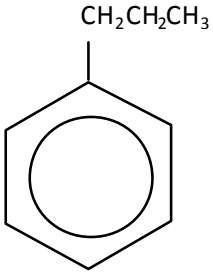
Q43. Predict the structure of X in the following reaction:



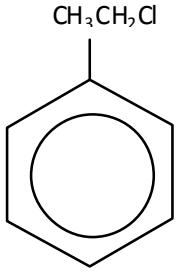
a.



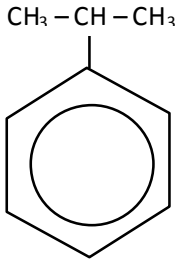
b.



c.



d.



Q44. Which one of the following is the sweetest sugar?

a. Glucose

b. Fructose

c. Lactose

d. Sucrose

Q45. 10.6g of a substance of molecular weight 106 was dissolved in 100mL. 10 mL of this solution was pipette out into a 1000 mL flask and made upto the mark with distilled water. The molarity of the resulting solution is:

a. 1.0 M

b. 10^{-2} M

c. 10^{-3} M

d. 10^{-4} M

Q46. A chemical reaction is catalysed by a catalyst X. Hence, X:

a. Reduces enthalpy of reaction

b. Decreases rate constant of the reaction

c. Increases rate constant of the reaction

d. Does not affect the equilibrium constant of the reaction.

Q47. The molarity of a solution made by mixing 50mL of conc. H_2SO_4 (36N) with 50 mL of water is:

a. 9 M

b. 10 M

c. 11 M

d. 12 M

Q48. Hybridization of Fe in $K_3Fe(CN)_6$ is:

a. sp^3

b. d^2sp^3

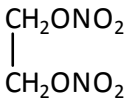
c. sp^3d^2

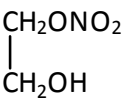
d. dsp^3

Q49. When ethylene glycol is heated with a mixture of concentrated HNO_3 and concentrated H_2SO_4 it produces:

a. 

b. $CO_2 + H_2$

c. 

d. 

Q50. An aqueous solution of glucose is 10% in strength. The volume in which 1-g mole of it is dissolved will be:

a. 0.18 L

b. 1.8 L

c. 0.9 L

d. 9.0 L

Q51. The correct order of hybridization of the central atom in the following species NH_3, $[PtCl_4]^{2-}$, PCl_5, and BCl_3 is:

a. sp^3, dsp^2, dsp^3, sp^2

b. dsp^2, dsp^3, sp^2, sp^3

c. sp^2, sp^3, dsp^2, dsp^3

d. sp^2, dsp^2, sp^3, dsp^3

Q52. An ester (A) with molecular formula $C_9H_{10}O_2$ was treated with excess of CH_3MgBr and the complex so formed was treated with H_2SO_4 to give an olefin (B). Ozonolysis of (B) gave a ketone with molecular formula C_8H_8O which shows +ve iodoform test. The structure of (A) is:

a. $C_6H_5COOC_2H_5$

b. $CH_3COCH_2COC_6H_5$

c. p- $CH_3O - C_6H_4 -COCH_3$

d. $C_6H_5COOC_6H_5$

Q53. The compound, N-ethyl-N-methylpropanamine forms non-superimposable mirror images but does not show optical activity. This is due to:

a. Absence of a chiral N-atom

b. Presence of a chiral N-atom

c. Presence of a lone pair on N-atom

d. Rapid flipping of one form into another

Q54. Which one of the following is incorrect for electrophoresis?

a. In electrophoresis, solution migrates either to anode or to the cathode depending upon the positively or negatively charged solution

b. Electrophoresis is a useful method for finding the charge of a solution.

c. Electrophoresis with a high potential is helpful in destroying an emulsion

d. Colloids are uncharged particles and do not migrate towards the electrodes when electric field is applied.

Q55. $(NH_4)_2Cr_2O_7$ on heating liberates a gas. The same gas will be obtained by:

a. Heating NH_4NO_3

b. Heating NH_4NO_2

c. Treating H_2O_2 with $NaNO_2$

d. Treating Mg_3N_2 with H_2O.

Q56. Which element has the maximum electron affinity?

a. F

b. Cl

c. Br

d. I

Q57. Number of water molecules in mohr's salt:

a. 5

b. 7

c. 6

d. 8

Q58. EMF of a cell in terms of reduction potential of its left and right electrodes is:

a. $E = E_{left} - E_{right}$

b. $E = E_{right} - E_{left}$

c. $E = E_{left} + E_{right}$

d. None of these

Q59. Amine is not formed in the reaction:

A. Hydrolysis of RCN

B. Reduction of RCH=NOH

C. Hydrolysis of RNC

D. Hydrolysis of $RCONH_2$

The correct answer is:

a. A, B, D

b. A, D

c. B, C

d. A, B, C

Q60. Potassium crystallizes in a bcc lattice, hence the co-ordination number of potassium metal is:

a. 0

b. 4

c. 6

d. 8

MATHEMATICS:

Q61. Derivative of $x^6 + 6^x$ with respect to x is:

(a) $12\,x$
(b) $x + 4$
(c) $6x^5 + 6^x \log 6$
(d) $6x^5 + x6^{x-1}$

Q62. If *A* and *B* are points on one bank of a straight river and *C, D* are two other points on the other bank of river. If direction from *A* to *B* is same as that from *C* to *D* and $AB = a$, $\angle CAD = \alpha$, $\angle DAB = \beta$, $\angle CBA = \gamma$, then *CD* is equal to:

(a) $\frac{a \sin\beta \sin\gamma}{\sin\alpha \sin(\alpha+\beta+\gamma)}$
(b) $\frac{a \sin\alpha \sin\gamma}{\sin\beta \sin(\alpha+\beta+\gamma)}$
(c) $\frac{a \sin\alpha \sin\beta}{\sin\gamma \sin(\alpha+\beta+\gamma)}$
(d) None of these

Q63. For the matrix $A = \begin{bmatrix} 1 & 1 & 0 \\ 1 & 2 & 1 \\ 2 & 1 & 0 \end{bmatrix}$, which of the following is correct?

(a) $2A^3 + 3A^2 - I = 0$
(b) $A^3 + 3A^2 - I = 0$
(c) $A^3 + 2A^2 - I = 0$
(d) $A^3 + A^2 - I = 0$

Q64. If 1, ω, ω^2 are the cube roots of unity, then

$\Delta = \begin{vmatrix} 1 & \omega^n & \omega^{2n} \\ \omega^n & \omega^{2n} & 1 \\ \omega^{2n} & 1 & \omega^n \end{vmatrix}$ is equal to:

(a) 0
(b) 1
(c) ω
(d) ω^2

Q65. The equation of the plane passing through (1, 1, 1) and (1, -1, -1) and perpendicular to $2x - y + z + 5 = 0$ is:

(a) $2x + 5y + z - 8 = 0$
(b) $x + y - z - 1 = 0$
(c) $2x + 5y + z + 4 = 0$
(d) $x - y + z - 1 = 0$

Q66. The vector equation of the plane passing through the origin and the line of intersection of the plane $\vec{\mathbf{r}} \cdot \vec{\boldsymbol{a}} = \lambda$ and $\vec{\mathbf{r}} \cdot \vec{\mathbf{b}} = \mu$, is:

(a) $\vec{\mathbf{r}} \cdot (\lambda \vec{\boldsymbol{a}} - \mu \vec{\mathbf{b}}) = 0$
(b) $\vec{\mathbf{r}} \cdot (\lambda \vec{\mathbf{b}} - \mu \vec{\boldsymbol{a}}) = 0$
(c) $\vec{\mathbf{r}} \cdot (\lambda \vec{\boldsymbol{a}} + \mu \vec{\mathbf{b}}) = 0$
(d) $\vec{\mathbf{r}} \cdot (\lambda \vec{\mathbf{b}} + \mu \vec{\boldsymbol{a}}) = 0$

Q67. Domain of the function $f(x) = \sqrt{\sin^{-1}(2x) + \frac{\pi}{6}}$ is:

(a) $\left[-\frac{1}{4}, \frac{1}{2}\right]$
(b) $\left[-\frac{1}{2}, \frac{1}{2}\right]$
(c) $\left[-\frac{1}{2}, \frac{1}{9}\right]$
(d) $\left[-\frac{1}{4}, \frac{1}{4}\right]$

Q68. A body travels a distance *s* in *t* seconds. It starts from rest and ends at rest. In the first part of the journey, it moves with constant acceleration *f* and in the second part with constant retardation r. The value of *t* is given by:

(a) $2s\left(\frac{1}{f} + \frac{1}{r}\right)$
(b) $\frac{2s}{\frac{1}{f} + \frac{1}{r}}$
(c) $\sqrt{2s(f + r)}$
(d) $\sqrt{2s\left(\frac{1}{f} + \frac{1}{r}\right)}$

Q69. Suppose that a die (with faces marked 1 to 6) is loaded in such a manner that for *K* = 1, 2, 3,….., 6 the probability of the face marked *K* turning up when die is tossed is proportional to *K*. The probability of the event that the outcome of a toss of the die will be an even number, is equal to:

(a) $\frac{1}{2}$
(b) $\frac{4}{7}$
(c) $\frac{2}{5}$
(d) $\frac{1}{21}$

Q70. India plays two matches each with West Indies and Australia. In any match the probabilities of India getting points 0, 1 and 2 are 0.45, 0.05 and 0.50 respectively. Assuming that the outcomes are independent, the probability of India getting at least 7 points, is:

(a) 0.8750
(b) 0.0875
(c) 0.0625
(d) 0.0250

Q71. If the tangent to the parabola $y^2 = ax$ makes an angle of 45° with x-axis, then the point of contact is:

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

Q72. Rational roots of the equation $2x^4 + x^3 - 11x^2 + x + 2 = 0$ are:

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

Q73. In an experiment 15 observations on x, the following results were available

$$\sum x^2 = 2830, \sum x = 170$$

One observation that was 20 found to be wrong and was replaced by the correct value 30. Then corrected variance is:

(a) 78.00
(b) 188.66
(c) 177.33
(d) 8.33

Q74. The general solution of $\frac{dy}{dx} = \frac{2x-y}{x+2y}$ is:

(a) $x^2 - xy + y^2 = c$
(b) $x^2 - xy - y^2 = c$
(c) $x^2 + xy - y^2 = c$
(d) $x^2 + xy^2 = c$

Q75. If y(t) is a solution of (1 + t) $\frac{dy}{dt} - ty = 1$ and $y(0) = -1$, then $y(1)$ is equal to:

(a) $-\frac{1}{2}$

(b) $e + \left(\frac{1}{2}\right)$

(c) $e - \frac{1}{2}$

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

Q76. The line $\frac{x}{a} - \frac{y}{b} = 1$ cuts the x-axis at *P*. The equation of the line through *P* perpendicular to the given line is:

(a) $x + y = ab$

(b) $x + y = a + b$

(c) $ax + by = a^2$

(d) $bx + ay = b^2$

Q77. The number of solutions of the inequality

$$2^{1/\sin^2\alpha_2}.\ 3^{1/\sin^2\alpha_3}.....n^{1/\sin^2\alpha_n} \leq n\ !$$

Where $\alpha_i \in (-\pi, 2\pi)$ for $i = 2, 3, ..., n$ is:

(a) 0

(b) 2^{n-1}

(c) 3^{n-1}

(d) None of these

Q78. If the function $f(x) = \frac{2x - \sin^{-1}x}{2x + \tan^{-1}x}$, $(x \neq 0)$ is continuous at each point of its domain, then the value of $f(0)$ is:

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

Q79. If $a_1, a_2, a_3, \ldots a_{4001}$ are terms of an AP such that $\frac{1}{a_1 a_2} + \frac{1}{a_2 a_3} + \ldots\ldots$ $+ \frac{1}{a_{4001} a_{4001}} = 10$ and $a_2 + a_{4000} = 50$, then $|a_1 - a_{4001}|$ is equal to:

(a) 20
(b) 30
(c) 40
(d) None of these

Q80. If orthocentre and circumcentre of triangle are respectively (1, 1) and (3, 2), then the co-ordinates of its centroid are:

(a) $\left(\frac{7}{3}, \frac{5}{3}\right)$
(b) $\left(\frac{5}{3}, \frac{7}{3}\right)$
(c) (7, 5)
(d) None of these

Q81. Assuming x to be so small that x^2 and higher powers of x can be neglected, then $\frac{\left(1+\frac{3}{4}x\right)^{-4}(16-3x)^{1/2}}{(8+x)^{2/3}}$ is approximately equal to:

(a) $1+\frac{305}{96}x$
(b) $1-\frac{305}{96}x$
(c) $1+\frac{96}{305}x$
(d) $1-\frac{96}{305}x$

Q82. The minimum value of $x^2+\frac{1}{1+x^2}$ is, at:

(a) $x=0$
(b) $x=1$
(c) $x=4$
(d) $x=3$

Q83. $\int_0^{\pi} x\, f(\sin x)dx$ is equal to:

(a) $\pi\int_0^{\pi} f(\sin x)dx$
(b) $\frac{\pi}{2}\int_0^{\pi/2} f(\sin x)dx$
(c) $\pi\int_0^{\pi/2} f(\sin x)dx$
(d) $\pi\int_0^{\pi} f(\cos x)dx$

Q84. The centre of gravity *G* of three particles of equal mass placed at the three vertices of a right angled isosceles triangle whose hypotenuse is equal to 8 unit is on the median through *A* such that *AG* is

(a) $\frac{4}{3}$ unit

(b) $\frac{8}{3}$ unit

(c) $\frac{5}{3}$ unit

(d) $\frac{10}{3}$ unit

Q85. *ABC* is triangle, right angled at *A*. t]The resultant of the forces acting along $\overrightarrow{\mathbf{AB}}$, $\overrightarrow{\mathbf{AC}}$ with magnitudes $\frac{1}{AB}$ and $\frac{1}{AC}$ respectively is the force along $\overrightarrow{\mathbf{AD}}$, where *D* is the foot of the perpendicular from *A* onto *BC*. The magnitude of the resultant is:

(a) $\frac{(AB)(AC)}{AB+AC}$

(b) $\frac{1}{AB}+\frac{1}{AC}$

(c) $\frac{1}{AD}$

(d) $\frac{AB^2+AC^2}{(AB)^2(AC)^2}$

Q86. $\int \sqrt{\frac{1+x}{1-x}}\ dx$ is equal to:

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

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

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

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

Q87. Consider the following statements:

1. Minimum distance between the circle
   $x^2 + y^2 + 14x - 12y + 60 = 0$
   and line $5x + 12y + 41 = 0$ is 1.
2. Minimum distance the circles
   $x^2 + y^2 - 2x + 4y + 1 = 0$ and
   $x^2 + y^2 + 2x - 4y - 4 = 0$ is 4.

Which of these is/are correct?

(a) Only (1)
(b) Only (2)
(c) Both of these
(d) None of these

Q88. $2^{3n} - 7n - 1$ is divisible by:

(a) 49
(b) 36
(c) 64
(d) 25

Q89. The area cut off from a parabola by any double ordinate is *k* times the corresponding rectangle contained by that double ordinate and its distance from the vertex, then *k* is:

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

Q90. In a triangle ABC, $a : b : c = 4 : 5 : 6$. The ratio of the radius of the circumcircle to that of the incircle is:

(a) 16/9
(b) 16/7
(c) 11/7
(d) 7/16