Exam Code

12th JEE 9.8,20

Test Booklet Code

1. Ten million electrons pass from point P to point Q in one micro second. The current and its direction is

(a) $1.6 \times 10^{-14}\mathrm{A}$, from point P to point Q
(b) $3.2 \times 10^{-14}\mathrm{A}$, from point P to point Q
(c) $1.6 \times 10^{-6}\mathrm{A}$, from point Q to point P
(d) $3.2 \times 10^{-12}\mathrm{A}$, from point Q to point P

2. 1 ampere current is equivalent to

(a) 6.25×10^{18} electrons s^{-1}
(b) 2.25×10^{-18} electrons s^{-1}
(c) 6.25×10^{14} electrons s^{-1}
(d) 2.25×10^{14} electrons s^{-1}

3. A current in a wire is given by the equation, $\mathrm{I} = 2\mathrm{x}^2 - 3\mathrm{t} + 1$ the charge through cross section of wire in time interval $\mathrm{t} = 3\mathrm{s}$ to $\mathrm{t} = 5\mathrm{s}$ is $\mathrm{t} = 5\mathrm{s}$ is

(a) $32.33\mathrm{C}$
(b) $43.34\mathrm{C}$
(c) $45.5\mathrm{C}$
(d) $42\mathrm{c}$

4. A wire of resistance 4Ω is used to wind a coil of radius $7\mathrm{cm}$. The wire has a diameter of $1.4\mathrm{mm}$ and the specific resistance of its material is $2 \times 10^{-2}\Omega\mathrm{m}$. The number of turns in the coil is

(a) 50
(b) 40
(c) 60
(d) 70

5. The electrical resistance of a conductor depends upon

(a) Size of conductor
(b) Temperature of conductor
(c) Geometry of conductor
(d) All of these

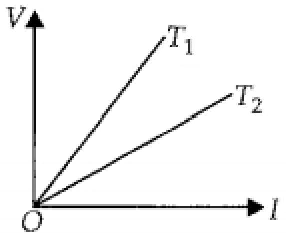
6. A cylindrical rod is reformed to half of its original length keeping volume constant. If its resistance before this change were R, then the resistance after reformation of rod will be

(a) R
(b) $R/4$
(c) $3\mathrm{R}/4$
(d) $\mathrm{R}/2$

7. Three resistors $2\Omega, 4\Omega$ and 5Ω are combined in parallel. This combination is connected to battery of emf $20\mathrm{V}$ and negligible internal resistance. The total current drawn from the battery is

(a) $10\mathrm{A}$
(b) $15\mathrm{A}$
(c) $19\mathrm{A}$
(d) $23\mathrm{A}$

8. The voltage V and current I graphs for a conductor at two different temperatures T_1 and T_2 are shown in the figure. The relation between T_1 and T_2 is

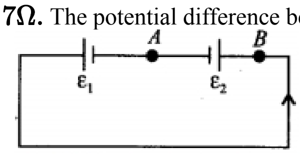


(a) $\mathrm{T}_1 > \mathrm{T}_2$
(b) $\mathrm{T}_1 < \mathrm{T}_2$
(c) $\mathrm{T}_1 = \mathrm{T}_2$
(d) $\mathrm{T}_1 = \dfrac{1}{\mathrm{T}_2}$

9. Two metal wires of identical dimensions are connected in series. If σ_1 and σ_2 and are the conductivities of the metals respectively, the effective conductivity of the combination is

(a) $\sigma_1 + \sigma_2$
(b) $\dfrac{\sigma_1 + \sigma_2}{2}$
(c) $\sqrt{\sigma_1\sigma_2}$
(d) $\dfrac{2\sigma_1\sigma_2}{\sigma_1 + \sigma_2}$

10. Two cells ε_1 and ε_2 connected in opposition to each other as shown in figure. The cell ε_1 is of emf $9\mathrm{V}$ and internal resistance 3Ω the cell ε_2 is of emf $7\mathrm{V}$ and internal resistance 7Ω. The potential difference between the points A and B is



(a) $8.4\mathrm{V}$
(b) $5.6\mathrm{V}$
(c) $7.8\mathrm{V}$
(d) $6.6\mathrm{V}$

11. The resistance of a heating element is 99Ω at room temperature. What is the temperature of the element if the resistance is found to be 116Ω?
(Temperature coefficient of the material of the resistor is $1.7 \times 10^{-4\circ}C^{-1}$)

(a) $999.9C$
(b) $1005.3C$
(c) $1020.2C$
(d) $1037.1C$

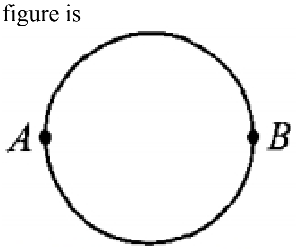
12. The resistance of the wire in the platinum resistance thermometer at ice point is 5Ω and at steam point is 5.25Ω . When the thermometer is inserted in an unknown hot bath its resistance is found to be 5.5Ω. The temperature of the hot bath is

(a) $100^\circ C$
(b) $200^\circ C$
(c) $300^\circ C$
(d) $350^\circ C$

13. A heater coil is rated $100W, 200V$. It is cut into two identical parts. Both parts are connected together in parallel, to the same source of $200V$. The energyl liberated per second in the new combination is

(a) $100J$
(b) $200J$
(c) $300J$
(d) $400J$

14. A wire of resistance 12 ohms per meter is bent to form a complete circle of radius $10cm$. The resistance between its two diametrically opposite points, A and B as shown in the figure is

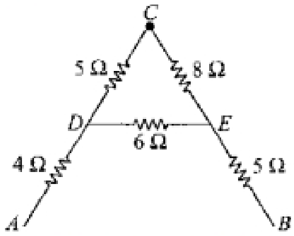


(a) 3Ω
(b) $6\pi\Omega$
(c) 6Ω
(d) $0.6\pi\Omega$

15. The total resistance in the parallel combination of three resistance $9\Omega, 7\Omega,$ and 5Ω is

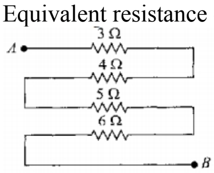
(a) 1.22Ω
(b) 2.29Ω
(c) 4.22Ω
(d) 2.02Ω

16. The equivalent resistance between A and B for the circuit shown in figure is



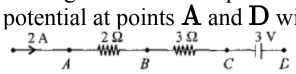
(a) 13.1Ω
(b) 15.1Ω
(c) 17.1Ω
(d) 19.1Ω

17. Equivalent resistance of the given network is



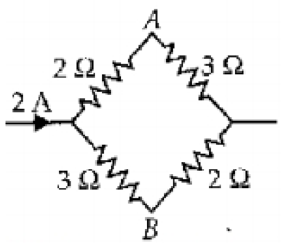
(a) 28
(b) 18
(c) 26
(d) 25

18. In the given circuit the potential at point B is zero, the potential at points A and D will be



(a) $V_a = 4V; V_D = 9V$
(b) $V_A = 3V; V_D = 4V$
(c) $V_A = 9V; V_D = 3V$
(d) $V_A = 4V; V_D = 3V$

19. The potential difference between A and B as shown in figure is



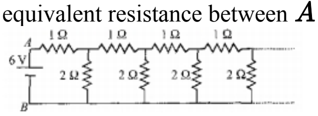
(a) $1V$
(b) $2V$
(c) $3V$
(d) $4V$

20. Three resistance, $2\Omega, 4\Omega, 5\Omega,$ are combined in series and this combination is connected to a battery of $12\mathrm{V}$ emf and negligible internal resistance. The potential drop across these resistances are

(a) $(5.45, 4.36, 2.18)\mathrm{V}$
(b) $(2.18, 5.45, 4.36)\mathrm{V}$
(c) $(4.36, 2.18, 5.45)\mathrm{V}$
(d) $(2.18, 4.36, 5.45)\mathrm{V}$

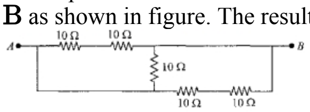
21. If voltage across a bulb rated $220\mathrm{V}$ $100\mathrm{W}$ drops by 2.5% of its rated value, the percentage of the rated value by which the power would decrease is $\%$

22. An infinite ladder network of resistance is constructed with 1Ω and 2Ω resistance as shown in figure. The $6\mathrm{V}$ battery between A and B has negligible internal resistance. The equivalent resistance between A and B is

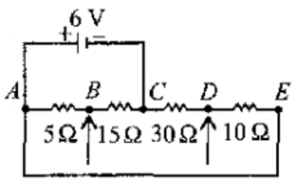


23. The equivalent resistance of series combination of Two equal resistors is S. If they are joined in parallel, the total resistance if P. The relation between S and P is given by $\mathrm{S} = \mathrm{nP}$. Then the minimum possible value of $\mathbf{n}$ is

24. Five equal resistances of 10Ω are connected between A and B as shown in figure. The resultant resistance is



25. Four resistors are connected as shown in the figure A $6V$ battery of negligible resistance is connected across terminals A and C. The potential difference across terminals B and D will be



26. A solid AB has the $NaCl$ structure. If radius of cation A^{+} is 120pm, calculate the maximum possible value of the radius of the anion B^{-}

(a) $240\mathrm{pm}$
(b) $280\mathrm{pm}$
(c) $270\mathrm{pm}$
(d) $290\mathrm{pm}$

27. $CsBr$ has a (bcc) arrangement and its unit cell edge length is 400 pm. Calculate the interionic distance in $CsCl$.

(a) $346.4\mathrm{pm}$
(b) $643\mathrm{pm}$
(c) $66.31\mathrm{pm}$
(d) $431.5\mathrm{pm}$

28. An ionic compound AB has ZnS type of structure, if the radius of A^{+} is $22.5\mathrm{pm},$ then the ideal radius of B^{-} is

(a) $54.35\mathrm{pm}$
(b) $100\mathrm{pm}$
(c) $145.16\mathrm{pm}$
(d) None

29. In a cubic packed structure of mixed oxides, the lattice is made up of oxide ions, one fifth of tetrahedral voids are occupied by divalent $\left(\mathrm{X}^{++}\right)$ ions while one- half of the octahedral voids are occupied by trivalent ions $\left(\mathrm{Y}^{+3}\right)$, then the formula of the oxide is.

(a) $\mathrm{XY_2O_4}$
(b) $\mathrm{X_2YO_4}$
(c) $\mathrm{X_4Y_5O_{10}}$
(d) $\mathrm{X_5Y_4O_{10}}$

30. A substance has density of $2\mathrm{kg\ dm}^{-3}$ & it crystallizes to fcc lattice with edge length equal to $700\mathrm{pm},$ then the molar mass of the substance is

(a) $75.50\mathrm{gmmol}^{-1}$
(b) $103.30\mathrm{gmmol}^{-1}$
(c) $56.02\mathrm{gmmol}^{-1}$
(d) $65.36\mathrm{gmmol}^{-1}$

31. The anions (a) form hexagonal closest packing and the cations(c) occupy only $2/3$ of octahedral holes. The simplest formula of the ionic compound is -

(a) CA
(b) $\mathrm{C_3A_2}$
(c) $\mathrm{C_4A_3}$
(d) $\mathrm{C_2A_3}$

32. An elemental crystal has a density of $8570\mathrm{kg/m}^{3}$. The packing efficiency is $0.68.$ The closest distance of approach between neighbouringatom is $2.86\mathrm{\AA}$. What is the mass of one atom approximately?

(a) 29 amu
(b) 39 amu
(c) 63 amu
(d) 93 amu

33. If Z is the number of atoms in the unit cell that represents the closest packing sequence $ABC\ ABC\ldots$, the number of tetrahedral voids in the unit cell is equal to -

(a) Z
(b) $2Z$
(c) $\frac{Z}{2}$
(d) $\frac{Z}{4}$

34. In a solid 'AB' having the $NaCl$ structure, 'A' atoms occupy the corners of the cubic unit cell. If all the face centred atoms along one of the axes are removed, then the resultant stoichiometry of the solid is -

(a) AB_2
(b) A_2B
(c) A_4B_3
(d) A_3B_4

35. When heated above $916^\circ C$, iron changes its bcc crystalline form to foc without the change in the radius of atom. The ratio of density of the crystal before heating and after heating is [At. wt. $Fe = 56$]

(a) 1.069
(b) 0.918
(c) 0.725
(d) 1.231

36. The crystal system for which $a \neq b \neq c$ and $\alpha = \beta = \gamma = 90^0$ is said to be :

(a) Triclinic
(b) Tetragonal
(c) Cubic
(d) Orthorhombic

37. A metal crystallizes in a body centered cubic lattice (bcc) with the edge of the unit cell 5.2Å. The distance between the two nearest neighbour is

(a) 10.4Å
(b) 4.5Å
(c) 5.2Å
(d) 9.0Å

38. Consider a Body Centered Cubic(bcc) arrangement, let d_e, d_{fd}, d_{bd} be the distances between successive atoms located along the edge, the face-diagonal, the body diagonal respectively in a unit cell.Their order is given by:

(a) $d_e < d_{fd} < d_{bd}$
(b) $d_{fd} > d_{bd} > d_e$
(c) $d_{fd} > d_e > d_{bd}$
(d) $d_{bd} > d_e > d_{fd}$

39. In zinc blende structure the coordination number of Zn^{2+} ion is

(a) 2
(b) 4
(c) 6
(d) 8

40. Strontium chloride has a fluorite structure, which of the following statement is true for the structure of strontium chloride?

(a) The strontium ions are in a body-centered cubic arrangement
(b) The strontium ions are in a face-centered cubic arrangement
(c) Each chloride ion is at the center of a cube of 8 strontium ions
(d) Each strontium ion is at the center of a tetrahedron of 4 chloride ions

41. Given an alloy of Cu, Ag and Au in which Cu atoms constitute the CCP arrangement.If the hypothetical formula of the alloy is Cu_4Ag_3Au . What are the probable locations of Ag and Au atoms.

(a) Ag - all Tetrahedral voids; Au - all Octahedral voids
(b) Ag - $3/8$th Tetrahedral voids; Au - $1/4$th Octahedral voids
(c) $Ag - 1/2$ Octahedral voids; $Au - 1/2$ Tetrahedral voids
(d) Ag - all Octahedral voids; Au - all tetrahedral voids

42. $NaCl$ shows Schottky defects and $AgCl$ Frenkel defects. Their electrical conductivity is due to :

(a) Motion of ions and not the motion of electrons
(b) Motion of electrons and not the motion of ions
(c) Lower co-ordination number of $NaCl$
(d) Higher co-ordination number of $AgCl$

43. Zinc Oxide, white in colour at room temperature, acquires yellow colour on heating due to:

(a) Zn being a transition element
(b) Paramagnetic nature of the compound
(c) Trapping of electrons at the site vacated by Oxide ions
(d) Both (a) & (b)

44. An element X (At. wt. $= 80g/mol$) having fce structure, calculate no. of unit cells in $8gm$ of X :

(a) $0.4 \times N_A$
(b) $0.1 \times N_A$
(c) $4 \times N_A$
(d) $N_A/40$

45. Which of the following solids are not correctly matched with the bonds found between the constituent particles:

(a) Solid CO_2 **:** Vanderwaal's
(b) Graphite : Covalent and Vanderwaal
(c) Grey Cast Iron : Ionic
(d) Metal alloys : Ions-delocalised electrons

46. In an ionic solid $r^{(+)} = 1.6$Å and $r^{(-)} = 1.864$Å . Use the radius ratio rule to determine the edge length of the cubic unit cell in Å.

47. A compound AB has a rock type structure with $A : B = 1 : 1$. The formula weight of AB is 6.023 y amu and the closest $A - B$ distance is $y^{1/3}$ nm. Determine the density of lattice in kg/m^3

48. A molecule A_2B (mol. wt. 166.4) occupies triclinic lattice with $a = 5$Å, $b = 8$Å and $c = 4$Å. If density of AB_2 is $5.2 gcm^{-3}$ calculate the number of molecules present in one unit cell —

49. The radius of Ag^+ ion is $126 pm$ while that of I^- ion is $216 pm.$ The co-ordination number of Ag in AgI is

50. The coordination number of a metal crystallized in a B.C.C. structure is

51. If $\cos^{-1}\left(\frac{x}{a}\right) + \cos^{-1}\left(\frac{y}{b}\right) = \alpha$, then $\frac{x^2}{a^2} - \frac{2xy}{ab}\cos\alpha + \frac{y^2}{b^2} =$

(a) $\sin^2\alpha$
(b) $\cos^2\alpha$
(c) $\tan^2\alpha$
(d) $\cot^2\alpha$

52. $2\left(\tan^{-1}1 + \tan^{-1}2 + \tan^{-1}3\right)$ is equal to

(a) $\pi/4$
(b) $\pi/2$
(c) π
(d) 2π

53. If $\tan^{-1}\frac{\sqrt{1-x^2}-1}{x} = 4,$ then

(a) $x = \tan 2$
(b) $x = \tan 4$
(c) $x = \tan(1/4)$
(d) $x = \tan 8$

54. The values of x satisfying $\tan\left(\sec^{-1}x\right) = \sin\left(\cos^{-1}\frac{1}{\sqrt{5}}\right)$ is/are

(a) $\frac{\sqrt{5}}{3}$
(b) $\frac{3}{\sqrt{5}}$
(c) $-\frac{\sqrt{5}}{3}$
(d) $-\frac{3}{\sqrt{5}}$

55. Which of the following is negative

(a) $\cos\left(\tan^{-1}(\tan 4)\right)$
(b) $\sin\left(\cot^{-1}(\cot 4)\right)$
(c) $\tan\left(\cos^{-1}(\cos 5)\right)$
(d) $\cot\left(\sin^{-1}(\sin 4)\right)$

56. Which of the following identities does not hold?

(a) $\sin^{-1}x = \cot^{-1}\left[\frac{\sqrt{(1-x^2)}}{x}\right]; 0 < x \le 1$
(b) $\sin^{-1}x = \cot^{-1}\left[\frac{\sqrt{(1-x^2)}}{x}\right]; -1 \le x < 0$
(c) $\sin^{-1}x = \cos^{-1}\sqrt{(1-x^2)}; 0 \le x \le 1$
(d) $\sin^{-1}x = 1 - \sin^{-1}(-x); -1 \le x \le 1$

57. If $\frac{1}{\sqrt{2}} < x < 1$ then $\cos^{-1}x + \cos^{-1}\left(\frac{x+\sqrt{1-x^2}}{\sqrt{2}}\right)$ is equal to

(a) $2\cos^{-1}x - \frac{\pi}{4}$
(b) $2\cos^{-1}x$
(c) $\frac{\pi}{4}$
(d) 0

58. Set of values of x satisfying $\cos^{-1}\sqrt{x} > \sin^{-1}\sqrt{x}$

(a) $\left(0, \frac{1}{2}\right)$
(b) $\left[0, \frac{1}{2}\right)$
(c) $\left(\frac{1}{2}, 1\right)$
(d) $\left(\frac{1}{2}, 1\right]$

59. Which one of the following is correct?

(a) $\tan 1 > \tan^{-1}$
(b) $\tan 1 < \tan^{-1} 1$
(c) $\tan 1 = \tan^{-1} 1$
(d) None of these

60. If $\cos^{-1} x + \cos^{-1} y + \cos^{-1} z = \pi$, then

(a) $x^2 + y^2 + z^2 + xyz = 0$
(b) $x^2 + y^2 + z^2 + 2xyz = 0$
(c) $x^2 + y^2 + z^2 + xyz = 1$
(d) $x^2 + y^2 + z^2 + 2xyz = 1$

61. The value of $\sin\left(2 . \sin^{-1} .8\right)$ is

(a) 0.64
(b) 0.36
(c) 0.96
(d) 0.84

62. $3\sin^{-1}\frac{2\mathrm{x}}{1+\mathrm{x}^2} - 4\cos^{-1}\frac{1-\mathrm{x}^2}{1+\mathrm{x}^2} + 2\tan^{-1}\frac{2\mathrm{x}}{1-\mathrm{x}^2} = \frac{\pi}{3}$ then principal $\mathrm{x} =$

(a) $\sqrt{3}$
(b) $\frac{1}{\sqrt{3}}$
(c) 1
(d) None of these

63. $\sin^{-1}\sin 22 + \cos^{-1}\cos 33 + \tan^{-1}\tan 44 =$

(a) $55 - 17\pi$
(b) $16\pi - 48$
(c) $45 - 18\pi$
(d) None of these

64. $\cos^{-1}\left\{\frac{1}{2}x^2 + \sqrt{1-x^2}\sqrt{1-\frac{x^2}{4}}\right\} = \cos^{-1}\frac{x}{2} - \cos^{-1} x$ holds if —

(a) $|x| \leq 1$
(b) $x \in R$
(c) $0 \leq x \leq 1$
(d) $-1 \leq x \leq 0$

65. If minimum value of $\left(\sin^{-1} x\right)^2 + \left(\cos^{-1} x\right)^2$ is $\frac{\pi^2}{k}$, then the value of $\mathbf{k}$ is

(a) 4
(b) 6
(c) 8
(d) None of these

66. All x satisfying the inequality $\left(\cot^{-1} x\right)^2 - 7\left(\cot^{-1} x\right) + 10 > 0$, lie in the interval:

(a) $(-\infty, \cot 5) \cup (\cot 4, \cot 2)$
(b) $(\cot 5, \cot 4)$
(c) $(\cot 2, \infty)$
(d) $(-\infty, \cot 5) \cup (\cot 2, \infty)$

67. Considering only the principal values of inverse functions, the set $A = \left\{x : \tan^{-1}(2x) + \tan^{-1}(3x) = \frac{\pi}{4}\right\}$

(a) is an empty set
(b) Contains more than two elements
(c) Contains two elements
(d) is a singleton

68. The value of $\sin^{-1}\left(\frac{12}{13}\right) - \sin^{-1}\left(\frac{3}{5}\right)$ is equal to :

(a) $\pi - \sin^{-1}\left(\frac{63}{65}\right)$
(b) $\pi - \cos^{-1}\left(\frac{33}{65}\right)$
(c) $\frac{\pi}{2} - \sin^{-1}\left(\frac{56}{65}\right)$
(d) $\frac{\pi}{2} - \cos^{-1}\left(\frac{9}{65}\right)$

69. If $\cos^{-1} x - \cos^{-1} \frac{y}{2} = \alpha$ where $-1 \leq x \leq 1, -2 \leq y \leq 2$, $x \leq \frac{y}{2}$ then for all $x, y, 4x^2 - 4xy\cos\alpha + y^2$ is equal to

(a) $4\sin^2\alpha - 2x^2y^2$
(b) $4\cos^2\alpha + 2x^2y^2$
(c) $4\sin^2\alpha$
(d) $2\sin^2\alpha$

70. If $\alpha = \sin^{-1}\left(\frac{4}{5}\right), \beta = \cot^{-1}(3)$, where $0 < \alpha, \beta < \frac{\pi}{2}$, then $\alpha - \beta$ is equal to :

(a) $\sin^{-1}\left(\frac{9}{5\sqrt{10}}\right)$
(b) $\tan^{-1}\left(\frac{9}{14}\right)$
(c) $\cos^{-1}\left(\frac{9}{5\sqrt{10}}\right)$
(d) $\tan^{-1}\left(\frac{9}{5\sqrt{10}}\right)$

71. $\tan^{-1} \mathrm{n}, \tan^{-1}(\mathrm{n}+1)$ and $\tan^{-1}(\mathrm{n}+2), \mathrm{n} \in \mathrm{N}$, are angles of a triangle if n..........

72. If $\sin^{-1}(\sin 5) > x^2 - 4x$, then the number of possible integral values of x is ....

73. Greatest value of $\tan^{-1}\left(\frac{1-x}{1+x}\right) \forall x \in [0,1]$ is $\frac{\pi}{k}$ then k equals

74. If $\sum_{i=1}^{10} \cos^{-1} x_i = 0$ then $\sum_{i=1}^{10} x_i$ is

75. If the range of m for which the equation $\operatorname{cosec}^{-1} \mathrm{x} = \mathrm{mx}$ has exactly two solutions is $\left(0, \frac{\lambda\pi}{10}\right]$ then λ is equal to

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Answer Key

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1. Answer: c

Solution

(c): Here, number of electron, n = 10000000 = 10^7 Total charge on ten million electrons is,

$Q = ne$ [where $e = 1.6\times10^{-19}C$]

$= 10^7 \times 1.6\times10^{-19}C$

$= 1.6\times10^{-12}C$

Time taken by ten million electrons to pass from point P to point Q is, $t = 1\mu s = 10^{-6}s$

The current,

$I = \frac{Q}{t} = \frac{1.6\times10^{-12}}{10^{-6}} = 1.6\times10^{-6}A$

Since the direction of the current is always opposite to the direction of flow of electrons. Therefore due to flow of electrons from point P to point Q the current will flow from point Q to pint. P.

2. Answer: a

Solution

(a): $Q = It$

Also $Q = ne$ [$e = 1.6\times10^{-19}C$]

$\therefore ne = It$

or (;k) $n = \frac{It}{e} = \frac{1A\times1s}{1.6\times10^{-19}}$

$= 6.25\times10^{18}$ electrons s^{-1}

3. Answer: b

Solution

(b): As $I = \frac{dQ}{dt}$

$dQ = Idt$

$dQ = (2t^2 - 3t + 1)\,dt$

$\int dQ = \int_{t=3}^{t=5}(2t^2 - 3t + 1)dt$

$Q = \left[\frac{2t^3}{3} - \frac{3t^2}{2} + t\right]_3^5$

$= \left[\frac{2}{3}(5^3 - 3^3) - \frac{3}{2}(5^2 - 3^2) + (5-3)\right]$

$= \left[\frac{2}{3}(125-27) - \frac{3}{2}(25-9) + 2\right] = 43.34C$

4. Answer: d

Solution

(d): Let n be the number of turns in the coil. Then total length of wire used, l

$= 2\pi r\times n = 2\pi\times 710^{-2}\times n$

Total resistance, $R = \rho\frac{l}{A}$

or , $4 = \frac{2\times10^{-7}\times2\pi\times10^{-2}\times n}{\pi(0.7\times10^{-3})^2}$

$\therefore$ n = 70

5. Answer: d

Solution

(d): The electrical resistance of a conductor is depend upon all factors size, temperature and geometry of conductor.

6. Answer: b

Solution

(b): The resistance of rod before reformation

$R_1 = R = \frac{\rho l_1}{\pi r_1^2}$ $\left[\therefore R = \frac{\rho l}{A} = \frac{\rho l}{\pi r^2}\right]$

Now the rod is reformed such that,

$l_2 = \frac{l_1}{2}$

$\therefore \pi r_1^2 l_1 = \pi r_2^2 l_2$ ($\because$ Volume remains constant,

or $\frac{r_1^2}{r_2^2} = \frac{l_2}{l_1}$ ...(i)

Now the resistance of the rod after reformation $R_2 = \frac{\rho l_2}{\pi r_2^2}$

$\therefore \frac{R_1}{R_2} = \frac{\rho l_1}{\pi r_1^2} \Big/ \frac{\rho l_1}{\pi r_2^2} = \frac{l_1}{l_2}\times\frac{r_2^2}{r_1^2}$

or, $\frac{R_1}{R_2} = \frac{l_1}{l_2}\times\frac{l_1}{l_2} = \left(\frac{l_1}{l_2}\right)^2 = (2)^2$ (using (i))

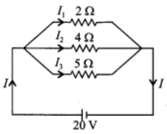
$\frac{R_1}{R_2} = 4$

$\therefore R_2 = \frac{R}{4}$

7. Answer: c

Solution

(c): Potential of 20 V will be same across each resistance current.



$I_1 = \frac{V}{R_1} = \frac{20}{2} = 10A$

$I_2 = \frac{V}{R_2} = \frac{20}{4} = 5A$

$I_3 = \frac{V}{R_3} = \frac{20}{5} = 4A$

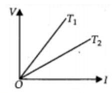
$\therefore$ Total current drawn circuit,

$I = I_1 + I_2 + I_3 = 10 + 5 + 4 = 19A$

8. Answer: a

Solution

(a):



The slope of $V - I$ graph gives the resistance of a conductor at a given temperature.

From the graph, T_1 is greater than at temperature T_2. As the resistance of a conductor is more at higher temperature and less at lower temperature, hence $T_1 > T_2$.

9. Answer: d

Solution

(d): Resistance of a wire in terms of conductivity (σ) is given by

$$R = \frac{1}{\sigma}\frac{1}{A}$$

where l is the length and A is the area of cross – section of wire respectively.

As the wires are onnected in series,

$$\therefore R_s = R_1 + R_2$$

$$\frac{2l}{\sigma_s A} = \frac{l}{\sigma_1 A} + \frac{l}{\sigma_2 A}$$

$$\frac{2}{\sigma_s} = \frac{1}{\sigma_1} + \frac{1}{\sigma_2 A} + \frac{1}{\sigma_2 A}$$

where σ_s is the effective conductivity

$$\frac{2}{\sigma_s} = \frac{1}{\sigma_1} + \frac{1}{\sigma_2} = \frac{\sigma_2 + \sigma_1}{\sigma_1 \sigma_2}$$

$$\sigma_s = \frac{2\sigma_1 \sigma_2}{\sigma_1 + \sigma_2}$$

10. Answer: a

Solution

(a): $I = \frac{\Delta\varepsilon}{r_1 + r_2} = \frac{9-7}{3+7} = \frac{2}{10} = 0.2A$

Potential difference across

$\varepsilon_1 = 9 - 0.2 \times 3 = 9 - 0.6$

$= 8.4V$

Potential difference across

$\varepsilon_2; V_{AB} = \varepsilon_2 + 0.2r_2$

$= 7 + 0.2 \times 7$

$7 + 1.4 = 8.4V$

11. Answer: d

Solution

(d): Here, $R_0 = 99\Omega$, $T_0 = 27°C$

$R_T = 116\Omega$

$\alpha = 1.710^{-4}\ °C^{-1}$

$\therefore R_T = R_0[(1 + \alpha(T - T_0)]$

$\therefore \frac{R_T}{R_0} - 1 = \alpha(T - T_0) \Rightarrow \frac{116}{99} - 1 = \alpha(T - T_0)$

$T - T_0 = \frac{1}{\alpha}\left[\frac{116 - 99}{99}\right] = \frac{17}{99o} = \frac{1}{1.7 \times 10^{-4}} \times \frac{17}{99}$

$\therefore T - T_0 = \frac{10^5}{99} = 1010.10\ °C$

$\Rightarrow T = 1010.1 + T_0 = 1010.1 + 27 = 1037.1\ °C$

12. Answer: b

Solution

(b): Here,

$R_0 = 5\Omega, R_{100} = 5.25\Omega, R_t = 5.5\Omega$

As,

$R_t = R_0(1 + \alpha t) \therefore R_{100} = R_0(1 + \alpha 100)$

$\alpha = \frac{R_{100} - R_0}{R_0 \times 100}$ ...(i)

Let the temperature of hot bath be $t\ °C$

$R_t = R_0(1 + \alpha t)$

$\alpha = \frac{R_t - R_0}{R_0 \times t}$

Equating equations (i) and (ii), we get

$\frac{R_{100} - R_0}{R_0 \times 100} = \frac{R_t - R_0}{R_0 \times t}$

$t = \frac{R_t - R_0}{R_{100} - R_0} \times 100 = \frac{5.5 - 5}{5.25 - 5} \times 100$

$$= \frac{0.5}{0.25} \times 100 = 200\ °C$$

13. Answer: d

Solution

(d): Resistance of heater coil,

$R' = \frac{V^2}{P} = \frac{200 \times 200}{100} = 400\Omega$

Resistance of either half part $= 200\Omega$.

Equivalent resistance when both parts are connected in parallel,

$R' = \frac{200 \times 200}{200 + 200} = 100\Omega.$

Energy liberated per second when combination is connected to a source of 200 V,

$= \frac{V^2}{R'} = \frac{200 \times 200}{100} = 400J.$

14. Answer: d

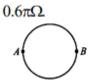
Solution

(d): Wire of length $2\pi \times 0.1$m of $12\Omega\,m^{-1}$ is bent to a circle.

Resistance of each part $= 12 \times \pi \times 0.1$

$= 1.2\pi\Omega$

$\therefore$ Total resistance $= 0.6\pi\Omega$



15. Answer: d

Solution

(d): In the parallel combination of three resistances, the equivalent resistance is.,

$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

or, $\frac{1}{R_{eq}} = \frac{1}{9} + \frac{1}{7} + \frac{1}{5} = \frac{35 + 45 + 63}{315} = \frac{143}{315}$

$R_{eq} = \frac{315}{143} = 2.02\Omega$

16. Answer: a

Solution

(a): For equivalent resistance between A and b. 5Ω and 8Ω resistances are connected in series. R', their equivalent resistance is parallel to 6Ω

$\therefore R' = 5+8 = 13\Omega$

and, $\frac{1}{R''} = \frac{1}{13} + \frac{1}{6} = \frac{6+13}{78} = \frac{19}{78}$

$R'' = \frac{78}{19}$

Now $4\Omega, R''$ and 5Ω resistances are connected in series equivalent resistance between A and B.

$\therefore R_{eq} = 4 + \frac{78}{19} + 5 = \frac{76+78+95}{19} = 13.1\Omega$

17. Answer: b

Solution

(b): Between points A and B all resistances are combined in series.

$\therefore R_{eq} = 3\Omega + 4\Omega + 5\Omega + 6\Omega = 18\Omega$

18. Answer: d

Solution

(d): $V_A - V_B = 2\times 2 = 4V$

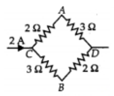
$\therefore V_A - 0 = 4V \Rightarrow V_A = 4V$

According to question $V_B = 0$

Point D is connected to positive terminal of battery of emf 3 V.

19. Answer: a

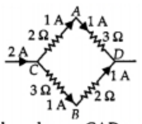
Solution



Resistance of the upper arm $CAD = 2\Omega + 3\Omega = 5\Omega$

Resistance of the lower arm $CBD = 3\Omega + 2\Omega = 5\Omega$

As the resistance of both arms are equal, therefore same amount of current flows in both the arms.



Current through each arm CAD or CBD = 1 A

Potential difference across C and A is

$V_C - V_A = (2\Omega)(1A) = 2V$ ....(i)

Potential difference across C and B is

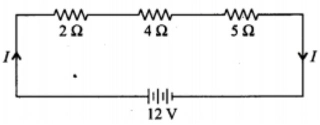
$V_C - V_B = (3\Omega)(1A) = 3V$ ....(ii)

Subtractin (i) from (ii), we get

$V_A - V_B = 3V - 2V = 1V$

20. Answer: d

Solution



Let current in the circuit is I. Then total resistance in the circuit

$R = R_1 + R_2 + R_3 = 2+4+5 = 11$

$\because V = IR$

$\because I = \frac{V}{R} = \frac{12}{11} A$

The potential drop across 2Ω resistance

$V_1 = IR_1 = \frac{12}{11} \times 2 = 2.18V$

The potential drop across 4Ω resistance

$V_2 = IR_2 = \frac{12}{11} \times 4 = 4.36V$

The potential drop across 5Ω resistance

$V_3 = IR_3 = \frac{12}{11} \times 5 = 5.45V$

Hence, $(V_1, V_2, V_3) = (2.18, 4.36, 5.45)V$

21. Answer: 5

Solution

Power, $P = \frac{V^2}{R}$

As the resistance of the bulb is constant

$\therefore \frac{\Delta P}{P} = \frac{2\Delta V}{V}$

% decrease in power

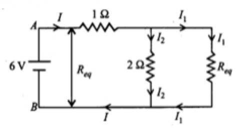
$= \frac{\Delta P}{P} \times 100 = \frac{2\Delta V}{V} \times 100$

$= 2 \times 2.5\% = 5\%$

22. Answer: 2

Solution

The equivalent circuit is,



$R_{eq} = 1 + \frac{2\times R_{eq}}{(2+R_{eq})} = \frac{2+3R_{eq}}{2+R_{eq}}$ i.e. $R_{eq}^2 - R_{eq} - 2 = 0$

$\Rightarrow R_{eq} = \frac{1}{2}\left[1 \pm \sqrt{1+8}\right] = 2\Omega.$

23. Answer: 4

24. Answer: 5

Solution

According to the given circuit 10Ω and 10Ω resistances are connected in series.

$\therefore R' = 10+10 = 20\Omega$

Again 10Ω and 10Ω resistances are connected in series

$\therefore R'' = 10+10 = 20\Omega$

R', R'' and 10Ω all connected in parallel than

$\therefore \frac{1}{R_{eq}} = \frac{1}{R'} + \frac{1}{R''} + \frac{1}{10} = \frac{1}{20} + \frac{1}{20} + \frac{1}{10} = \frac{1+1+2}{20}$

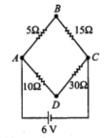
$= \frac{4}{20} = \frac{1}{5}$

$R_{eq} = 5\Omega$

25. Answer: 0

Solution

The given figure is a circuit of balanced wheatstone bridge as shown in the figure.



Points B and D would be at the same potential,
i.e., $V_B - V_D = 0$ volt

26. Answer: d

Solution

We know that for the NaCl structure

radius of cation/radius of anion = 0.414; $\frac{r_{A^+}}{r_{B^-}} = 0.414$

$r_{B^-} = \frac{r_{A^+}}{0.414} = \frac{120}{0.414} = 290\,pm$

27. Answer: a

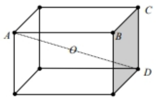
Solution

The (bcc) structure of $CsBr$ is given in figure
The body diagonal $AD = a\sqrt{3}$, where a is the length of edge of unit cell
On the basis of figure
$AD = 2(r_{Cs^+} + r_{Cl^-})$

$a\sqrt{3} = 2(r_{Cs^+} + r_{Cl^-})$

or $(r_{Cs^+} + r_{Cl^-}) = \frac{a\sqrt{3}}{2} = 400 \times \frac{\sqrt{3}}{2}$

$= 200 \times 1.732 = 346.4\,pm$



28. Answer: b

Solution

Since ionic compound AB has Zns type of structure, therefore it has tetrahedral holes, for which

$\frac{\text{radius of cation}}{\text{radius of anion}} = 0.225$

$\frac{r^+}{r_-} = 0.225$

$\frac{22.5}{r_-} = 0.225$

Hence $r_- = 100$ pm

29. Answer: c

Solution

In ccp anions occuply primitives of the cube while cations occupied voids. In ccp there are two tetrahedral voids and one octahedral holes per anion.
For one oxygen atom there are two tetrahedral holes and one octahedral hole.
Since one fifth of the tetrahedral voids are occupied by divalent cations (X^{2+})

$\therefore$ Number of divalent cations in tetrahedral voids = $2 \times \frac{1}{5}$

Since half of the octaheadral voids are occupied by trivalent cations (Y^{3+})

$\therefore$ number of trivalent cations in octaheadral voids = $1 \times \frac{1}{2}$

So the formula is the compound is $(X)_{2\times\frac{1}{5}}(Y)_{\frac{1}{2}}(O)_1$

or $(X)_{\frac{2}{5}}(Y)_{\frac{1}{2}}(O)_1$.

or $X_4\,Y_5\,O_{10}$

30. Answer: b

Solution

$\rho = \frac{n \times M_m}{N_A \times a^3}$

$2 = \frac{4 \times M_m}{6.023 \times 10^{23} \times (7 \times 10^{-8})^3}$

(Since, effective number of atoms is unit cell = 4) on solving we get M_m = 103. 03 gm/mol

31. Answer: d

Solution

The no. of A in one unit cell = 6

The no. of C in one unit cell = $\frac{2}{3} \times 6 = 4$

$\therefore$ m.f is $C_4A_6 \equiv C_2A_3$

32. Answer: d

Solution

The packing efficiency = 0.68, means the given lattice is BCC.
The closest distance of approach = 2r

$2r = 2.86\,A^0 = \frac{\sqrt{3}a}{2}$ ora = $\frac{2 \times 2.86}{\sqrt{3}} = 3.30\,A^o$.

Let at. wt. of the element = a

$\therefore \frac{2 \times a}{36 \times 10^{23} \times (3.3)^3 \times 10^{-24}} = 8.57$

$a = 8.57 \times 3 \times (3.3)^3 \times 0.1 = 92.39 \simeq 93$

33. Answer: b

Solution

No. of Tetrahedral Void = 2 × No. of atom
Tetrahedral Void = 2Z

34. Answer: d

Solution

A_3B_4

35. Answer: b

Solution

$\rho_1 = \frac{2 \times 56}{\left(\frac{4r}{\sqrt{3}}\right)^3}$

$\rho_2 = \frac{4 \times 56}{\left(2\sqrt{2}r\right)^3}$ $\therefore \frac{\rho_1}{\rho_2} = 0.918$

36. Answer: d

Solution

Orthorhombic crystal system has $a \neq b \neq c$ and $\alpha = \beta = \gamma = 90^0$.

37. Answer: b

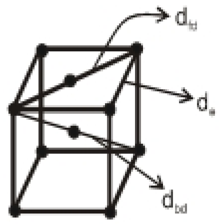
Solution

Distance between two nearest neighbours in bcc = $\frac{\sqrt{3}a}{2}$

$= \frac{\sqrt{3}\times\sqrt{2}}{2} = \frac{1.732\times\sqrt{2}}{2} = 4.503$ Å.

38. Answer: c

Solution



$d_e = a$

$d_{fd} = \sqrt{2}a$

$d_{bd} = \frac{\sqrt{3}a}{2}$

$\therefore d_{fd} > d_e > d_{bd}$

39. Answer: b

Solution

Coordination number of Zn^{2+} ion in Zinc blende = 4.
Zn^{2+} ion present in half of tetrahedral void formed by S^{2-} in fcc unit cells.

40. Answer: b

Solution

$SrCl_2$ is AB_2 type in which cation is of large size.

41. Answer: b

Solution

$\underset{\downarrow}{Cu_4}$ $\underset{\downarrow}{Ag_3}$ $\underset{\downarrow}{Au}$

Froms c.c.p. , $\frac{3}{8}$ th of tetrahedral voids , $\frac{1}{4}$ of Octahedral voids [$\therefore$ No. of O- voids = 4]
z = 4, [$\therefore$ No. of T- voids = 8].

42. Answer: a

Solution

Ions are displaced from one place to another.

43. Answer: c

Solution

Some of O^{2-} combine with each other forming O_2 gas which is liberated learning behind electrons at the site vacated by oxide ions.

44. Answer: d

Solution

Effective no. of atom in a unit cell = 4

no. of atom = $\frac{8}{80} \times N_A$

$\therefore$ no of unit cell = $\frac{N_A}{10} \times \frac{1}{4} = \frac{N_A}{40}$

45. Answer: c

Solution

Grey Cast Iron is metallic solid.

46. Answer: 4

47. Answer: 5

Solution

AB has rock salt structure.
The edge length of the unit cell = 2 (d_{A-B})
$= 2 \times y^{1/3} \times 10^{-9}$ m

Density of AB $= 4 \times 6.023 \times y \times \frac{10}{6.023}$

$\times 10^{-27} \times \frac{1}{2^3 y \times 10^{-27}} \frac{kg}{m^3}$

$= 4 \times y \times 10 \times \frac{1}{8y} = 5$ kg/m³

48. Answer: 3

49. Answer: 6

50. Answer: 8

51. Answer: a

Solution

We have $\cos^{-1}\left[\frac{x}{a}.\frac{y}{b} - \sqrt{\left(1-\frac{x^2}{a^2}\right)}\sqrt{\left(1-\frac{y^2}{b^2}\right)}\right] = \alpha$

$\Rightarrow \frac{xy}{ab} - \sqrt{\left(1-\frac{x^2}{a^2}\right)}\sqrt{\left(1-\frac{y^2}{b^2}\right)} = \cos\alpha$

$\therefore \left(\frac{xy}{ab} - \cos\alpha\right)^2 = 1 - \frac{x^2}{a^2} - \frac{y^2}{b^2} + \frac{x^2y^2}{a^2b^2}$

$\frac{x^2y^2}{a^2b^2} + \cos^2\alpha - \frac{2xy}{ab}\cos\alpha = 1 - \frac{x^2}{a^2} - \frac{y^2}{b^2} + \frac{x^2y^2}{a^2b^2}$

$\Rightarrow \frac{x^2}{a^2} - \frac{2xy}{ab}\cos\alpha + \frac{y^2}{b^2} = 1 - \cos^2\alpha = \sin^2\alpha$

52. Answer: d

Solution

The given expression is equal to

$$2\left[\pi + \tan^{-1}\frac{1+2}{1-2} + \tan^{-1}3\right]$$

$$= 2\left(\pi - \tan^{-1}3 + \tan^{-1}3\right) = 2\pi$$

53. Answer: d

Solution

Taking $x = \tan\theta, \tan^{-1}\frac{\sqrt{1-x^2}-1}{x} = \tan^{-1}\frac{\sec\theta - 1}{\tan\theta}$

$= \tan^{-1}\frac{1-\cos\theta}{\sin\theta} = \tan^{-1}\left(\tan\frac{\theta}{2}\right) = \left(\frac{1}{2}\right)\theta = \left(\frac{1}{2}\right)\tan^{-1}x$

So that according to the given condition

$\left(\frac{1}{2}\right)\tan^{-1}x = 4 \Rightarrow \tan^{-1}x = 8$ or $x = \tan 8$

54. Answer: b

Solution

$\tan(\sec^{-1}x) = \sin\cos^{-1}\left(\frac{1}{\sqrt{5}}\right)$

from the given equation it is clear that x is positive.

Let $\sec^{-1}x = \theta \Rightarrow \sec\theta = x \Rightarrow \tan\theta = \frac{2}{\sqrt{5}}$

$\Rightarrow x^2 = 1 + \frac{4}{5} \Rightarrow x^2 = \frac{9}{5} \Rightarrow x = \frac{3}{\sqrt{5}}$

55. Answer: d

Solution

(a) $\cos(\tan^{-1}(\tan 4)) = \cos(\tan^{-1}\tan(4-\pi))$
$= \cos(4-\pi) = -\cos 4 > 0$
(b) $\sin(\cot^{-1}(\cot 4)) = \sin(\cot^{-1}(\cot 4 - \pi))$
$\sin(4-\pi) = -\sin 4 > 0$
(c) $\tan(\cos^{-1}(\cos 5)) = \tan(\cos^{-1}\cos(2\pi - 5))$
$= \tan(2\pi - 5) = -\tan 5 > 0$
(d) $\cot(\sin^{-1}(\sin 4)) = \cot(\sin\sin^{-1}(\pi - 4))$
$= \cot(\pi - 4) = -\cot 4 < 0$

56. Answer: b

Solution

L.H.S. of choice (B) is a negative number and R.H.S. is a positive number.

57. Answer: c

Solution

Here, the expression could be written as

$\Rightarrow \cos^{-1}x + \cos^{-1}\left\{x.\frac{1}{\sqrt{2}} + \sqrt{1-x^2}.\sqrt{1-\left(\frac{1}{\sqrt{2}}\right)^2}\right\}$

$\Rightarrow \cos^{-1}x + \cos^{-1}\frac{1}{\sqrt{2}} - \cos^{-1}x$

$\left\{\because \frac{1}{\sqrt{2}} < x \Rightarrow \cos^{-1}\frac{1}{\sqrt{2}} > \cos^{-1}x\right\}$

$\Rightarrow \cos^{-1}\frac{1}{\sqrt{2}} = \frac{\pi}{4}$

58. Answer: b

Solution

$\cos^{-1}\sqrt{x} > \frac{\pi}{2} - \cos^{-1}\sqrt{x}$ $[\because x \geq 0]$

$\cos^{-1}\sqrt{x} > \frac{\pi}{4}$

$\Rightarrow \frac{\pi}{4} < \cos^{-1}\sqrt{x} \leq \frac{\pi}{2}$

$0 \leq \sqrt{x} < \frac{1}{\sqrt{2}}$

$0 \leq x < \frac{1}{2}$

59. Answer: a

Solution

$1 \text{ rad} > 45^0 \therefore \tan 1 > \tan 45^0$

$\Rightarrow \tan 1 > 1$

Also $\tan^{-1}(1) = \frac{\pi}{4} < 1,$

Hence, $\tan 1 > \tan^{-1}(1)$

60. Answer: d

Solution

(d) $\Rightarrow \cos^{-1}(x) + \cos^{-1}(y) + \cos^{-1}(z) = \cos^{-1}(-1)$
$\Rightarrow \cos^{-1}(x) + \cos^{-1}(y) = \cos^{-1}(-1) - \cos^{-1}(z)$
$\Rightarrow \cos^{-1}(xy - \sqrt{1-x^2}\sqrt{1-y^2}) = \cos^{-1}\{(-1)(z)\}$
$\Rightarrow xy - \sqrt{(1-x^2)(1-y^2)} = -z$
squaring both sides we get
$x^2 + y^2 + z^2 + 2xyz = 1$
Trick : Put $x = y = z = \frac{1}{2}$
so $\cos^{-1}\frac{1}{2} + \cos^{-1}\frac{1}{2} + \cos^{-1}\frac{1}{2} = \pi$
Obviously (D) holds for these values of x, y, z.

61. Answer: c

Solution

$\sin(2\sin^{-1}(0.8) = 2.\left(\frac{8}{10}\right)\sqrt{\left(1 - \frac{64}{100}\right)} = 0.96$

62. Answer: b

Solution

Put $x = \tan\theta$ solution $= \frac{1}{\sqrt{3}}$

63. Answer: a

Solution

$\sin^{-1}\sin 22 = 7\pi - 22$, $\cos^{-1}\cos 33 = 33 - 10\pi$
$\tan^{-1}\tan 44 = 44 - 14\pi$
Hence $7\pi - 22 + 33 - 10\pi + 44 - 14\pi$, $55 - 17\pi$

64. Answer: c

Solution

RHS : $\cos^{-1}\frac{x}{2} - \cos^{-1}2$

$\cos^{-1}\left\{\frac{1}{2}x^2 + \sqrt{1-x^2}\sqrt{1-\frac{x^2}{4}}\right\}$

considering $\cos^{-1}\frac{x}{2} \geq \cos^{-1}x \Rightarrow \frac{x}{2} \leq x$

True for all positive x also for $\cos^{-1}x - 1 \leq x \leq 1$

Hence : $0 \leq x \leq 1$

65. Answer: c

Solution

(c) $(\sin^{-1}x)^2 + \left(\frac{\pi}{2} - \sin^{-1}x\right)^2$

$= 2(\sin^{-1}x)^2 - \pi\sin^{-1}x + \frac{\pi^2}{4}$

so minimum value is that expression is $\frac{\pi^2}{8}$

so, $k = 8$

66. Answer: d

Solution

67. Answer: d

Solution

68. Answer: c

Solution

69. Answer: c

Solution

70. Answer: a

Solution

71. Answer: 1

Solution

Sol. $\tan^{-1}n + \tan^{-1}(n+1) + \tan^{-1}(n+2) = \pi$

$\tan^{-1}n + \pi + \tan^{-1}\frac{(n+1+n+2)}{(1-(n+1)(n+2))} = \pi$

$\tan^{-1}n + \pi - \tan^{-1}\frac{(2n+3)}{(n^2+3n+1)} = \pi$

$= \frac{2n+3}{n^2+3n+1}$

$n^3 + 3n^2 - n - 3 = 0$

$\boxed{n = 1}$ as $n \in N$

72. Answer: 3

Solution

Sol. $\because 5 - 2\pi > x^2 - 4x$

$\therefore x^2 - 4x + 2\pi - 5 < 0$

$\Rightarrow 2 - \sqrt{9-2\pi} < x < 2 + \sqrt{9-2\pi}$

Integer value of x = 1, 2, 3

$\therefore$ number of values = 3

73. Answer: 4

Solution

$\therefore \tan^{-1}\left(\frac{1-x}{1+x}\right) = \tan^{-1}1 - \tan x = \frac{\pi}{4}$ [for maximum]

74. Answer: 10

Solution

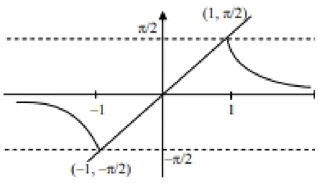
Sol. $0 \leq \cos^{-1}x \leq \pi$. Hence, from the question,

$\cos^{-1}x_i = 0$ for all i.

$\therefore x_i = 1$ for all i.

75. Answer: 5

Solution



From graph it is clear that $m \in \left(0, \frac{\pi}{2}\right]$ $\therefore \lambda = 5$