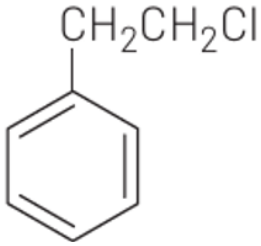
Max Marks: 300 **SR_FTB(WEEK-3) (06-07-2026)** **Time: 180 mins**

Chemistry

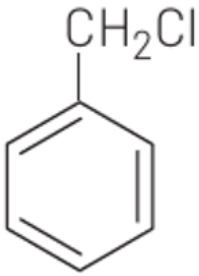
1. Which of the following will not undergo S_N1 reaction with OH^-?

A) $CH_2 = CH - CH_2Cl$ **B)** $(CH_3)_3CCl$

C)

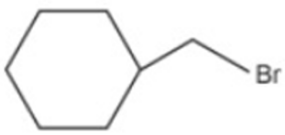


D)

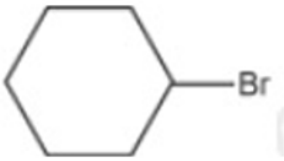


2. The compound that will undergo S_N1 reaction with the fastest rate is:

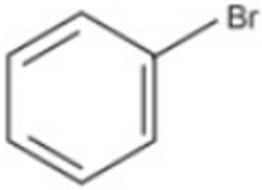
A)



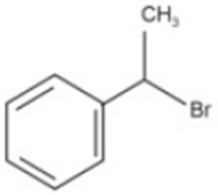
B)



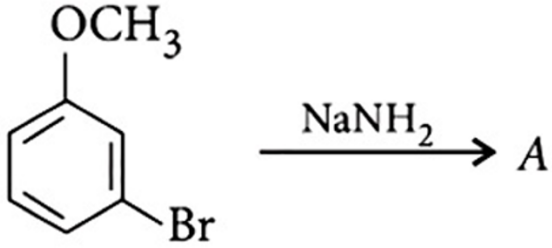
C)



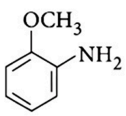
D)



3. Identify A and predict the type of reaction.

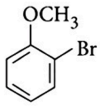


A)



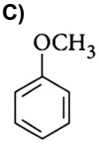
and elimination addition reaction

B)



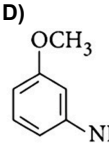
and cine substitution reaction

C)



and cine substitution

D)



and substitution reaction

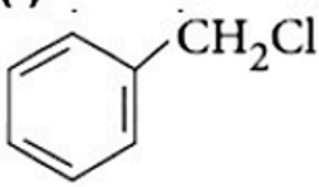
4. Consider the reaction,
$CH_3CH_2CH_2Br + NaCN \rightarrow CH_3CH_2CH_2CN + NaBr$
. This reaction will be the fastest in:

A) ethanol **B)** methanol

C) N,N'-dimethylformamide (DMF) **D)** water

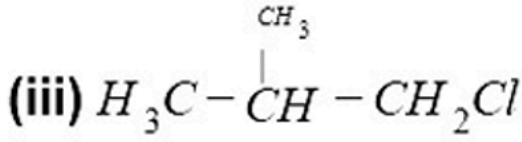
5. Which of the following compounds will undergo racemisation when solution of KOH hydrolyses?

(i)

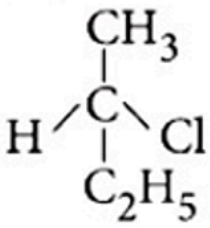


(ii) $CH_3CH_2CH_2Cl$

(iii)



(iv)



A) (i) and (ii) **B)** (ii) and (iv)

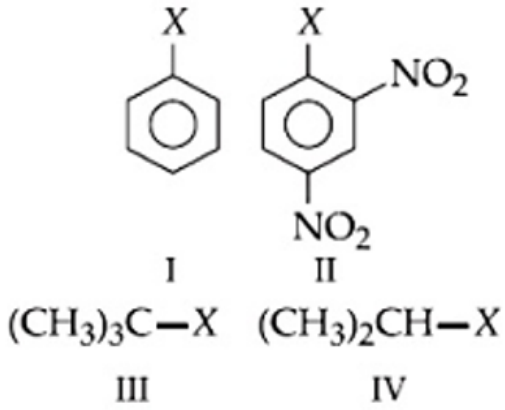
C) (iii) and (iv) **D)** Only (iv)

6. The mechanisms of reactions (i)
$(CH_3)_2CH - CH_2Br \xrightarrow{C_2H_5OH} (CH_3)_2CH - CH_2OC_2H_5 + HI$
and (ii)
$(CH_3)_2CH - CH_2Br \xrightarrow{C_2H_5O^-} (CH_3)_2CH - CH_2OC_2H_5 + Br^-$
are respectively:

A) S_N1 and S_N2 **B)** S_N1 and S_N1

C) S_N2 and S_N2 **D)** S_N2 and S_N1

7. The correct order of increasing reactivity of



I $(CH_3)_3C-X$ II $(CH_3)_2CH-X$

III IV

$C-X$ **bond towards nucleophile in the following compounds is:**

A) I < II < IV < III **B)** II < III < I < IV

C) IV < III < I < II **D)** III < II < I < IV

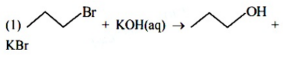
8. Assertion A : Hydrolysis of an alkyl chloride is a slow reaction but in the presence of NaI, the rate of the hydrolysis increases. Reason R : I^- is a good nucleophile as well as a good leaving group. In the light of the above statements, choose the correct answer from the options given below.

A) A is false but R is true **B)** A is true but R is false

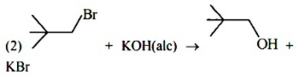
C) Both A and R are true and R is the correct explanation of A **D)** Both A and R are true but R is NOT the correct explanation of A

9. Identify the incorrect option from the following:

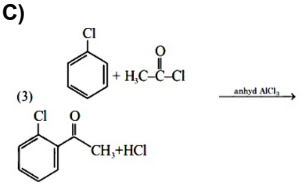
A)



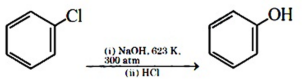
B)



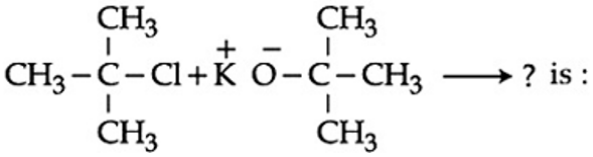
C)



D)



10. The major product in the reaction:

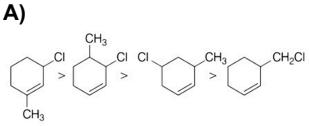


A) t-Butyl ethyl ether **B)** 2,2-Dimethyl butane

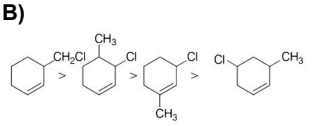
C) 2-Methyl pent-1-ene **D)** 2-Methyl prop-1-ene

11. The correct order of reactivity of the given chlorides with acetate in acetic acid is:

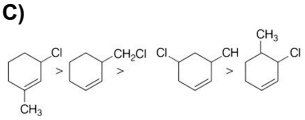
A)



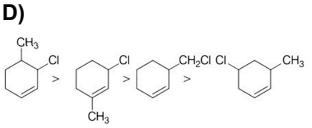
B)



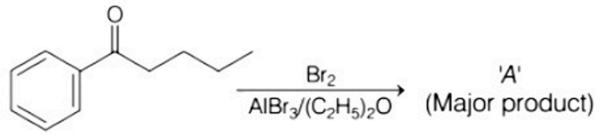
C)



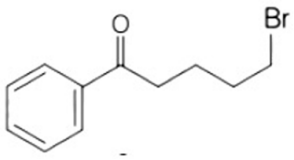
D)



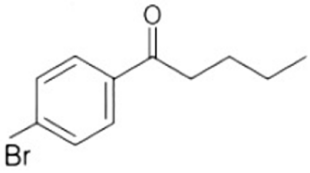
12. Consider the given reaction, the product A is



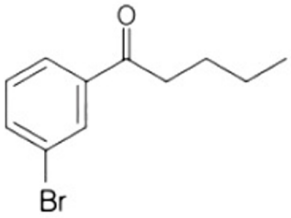
A)



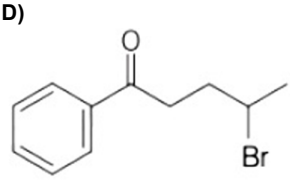
B)



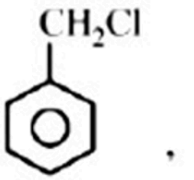
C) C)



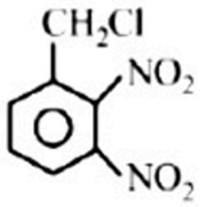
D)



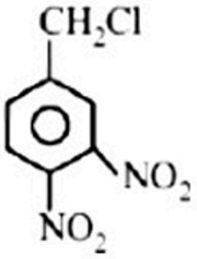
13. The decreasing order of reactivity of the following compounds towards nucleophilic substitution ( ) is:



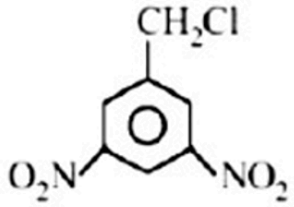
(I)



(II)



(III)

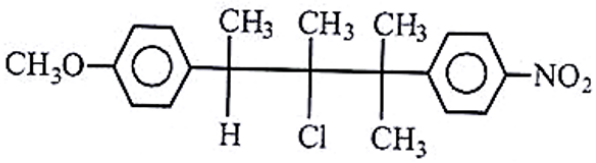


(IV)

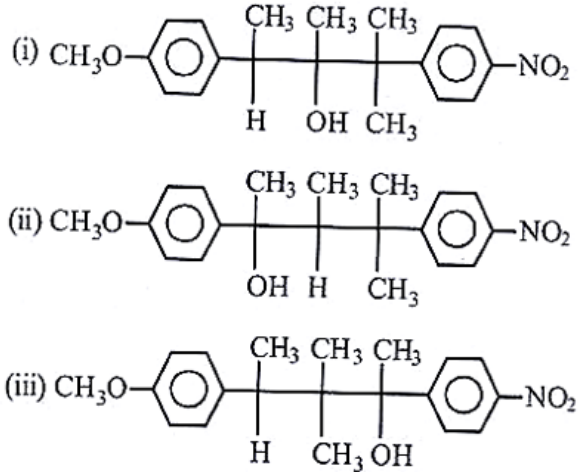
A) (II) > (III) > (I) > (IV) **B)** (II) > (III) > (IV) > (I)

C) (III) > (II) > (I) > (IV) **D)** (IV) > (II) > (III) > (I)

14.



Compound on hydrolysis in aqueous acetone will give



A) Mixture of (i) and (ii) **B)** Mixture of (i) and (iii)
C) Only (iii) **D)** Only (i)

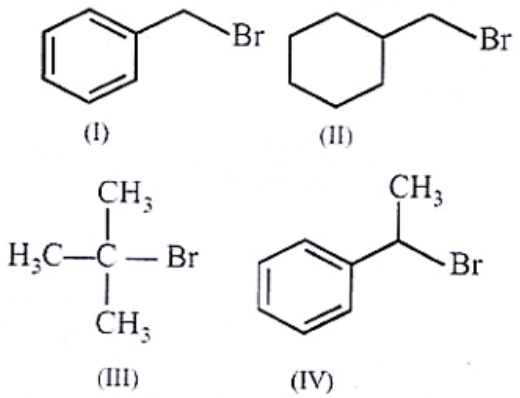
15. An reaction at an asymmetric carbon of a compound always gives:

A) an enantiomer of the substrate **B)** a product with opposite optical rotation
C) a mixture of diastereomers **D)** a single stereoisomer

16. Which of the following has the highest nucleophilicity?

A) F^- **B)** OH^-
C) CH_3^- **D)** NH_2^-

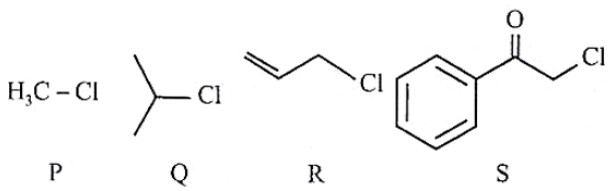
17. For the following compounds, the correct statement(s) with respect to nucleophilic substitution reaction is(are):



A) I and III follow S_N1 mechanism B) I and II follow S_N2 mechanism C) Compound IV undergoes inversion of configuration D) All are correct

A) Only A **B)** Only A and C
C) Only B and D **D)** Only A, B and C

18. KI in acetone undergoes S_N2 reaction with each of P, Q, R and S. The rate of the reaction vary as :

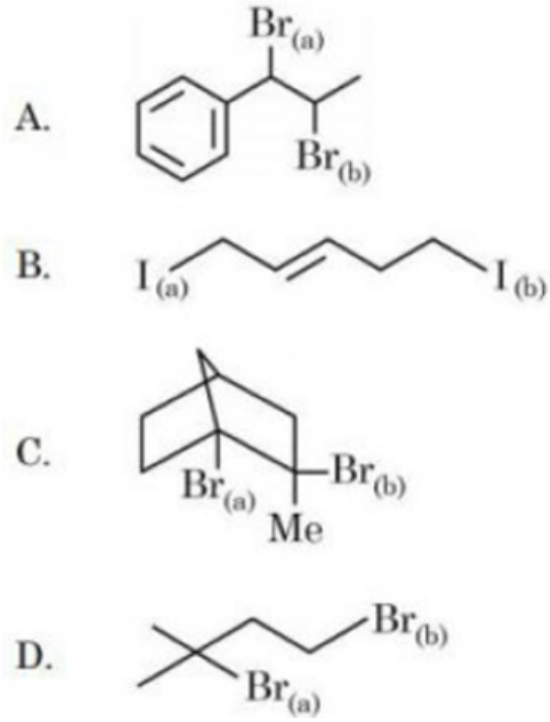


A) $P > Q > R > S$ **B)** $S > P > R > Q$
C) $P > R > Q > S$ **D)** $R > P > S > Q$

19. Statement-1: Bromobenzene upon reaction with Br_2/Fe gives 1,4-dibromobenzene as the major product. Statement-2: In bromobenzene, the inductive effect of the bromo group is more dominant than the mesomeric effect in directing the incoming electrophile

A) Both are correct, and Statement-2 is the correct explanation of Statement-1 **B)** Both are correct, but Statement-2 is NOT the correct explanation of Statement-1
C) Statement-1 is correct, but Statement-2 is incorrect **D)** Statement-1 is incorrect, but Statement-2 is correct

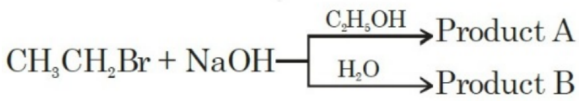
20. Choose the halogen which is most reactive towards S_N1 reaction in the given compounds (A, B, C, & D).



A) A— $Br_{(a)}$; B— $I_{(a)}$; C— $Br_{(b)}$; D— $Br_{(a)}$ **B)** A— $Br_{(b)}$; B— $I_{(a)}$; C— $Br_{(a)}$; D— $Br_{(a)}$
C) A— $Br_{(b)}$; B— $I_{(b)}$; C— $Br_{(b)}$; D— $Br_{(b)}$ **D)** A— $Br_{(a)}$; B— $I_{(a)}$; C— $Br_{(a)}$; D— $Br_{(a)}$

21. 2-chlorobutane $+Cl_2 \rightarrow C_4H_8Cl_2$ (isomers) Total number of optically active isomers shown by $C_4H_8Cl_2$ obtained in the above reaction is

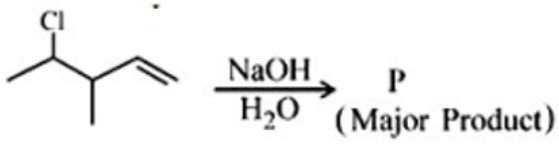
22.



The total number of hydrogen atoms in product A and product B is

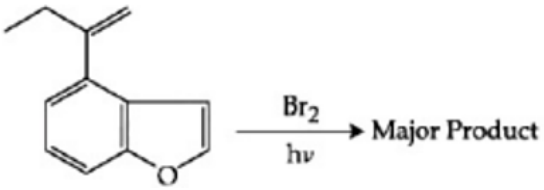
A) The question does not provide specific options A, B, C, and D in the document for this question.

23.



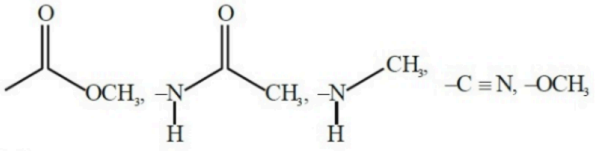
Consider the above reaction. The number of pi electrons present in the product 'P' is _____

24.



The major product of the following reaction contains ____ bromine atom(s).

25.



Total number of deactivating groups in aromatic electrophilic substitution reaction among the following is $CH_3, -N(H)COCH_3, -N(H)CH_3, -C \equiv N, -OCH_3$

Maths

26. If the circle $x^2 + y^2 - 2gx + 6y - 19c = 0, ; g, c \in \mathbb{R}$ passes through the point $(6, 1)$ and its centre lies on the l $x - 2cy = 8$, then the length of the intercept made by the circle on the x-axis is:

A) $\sqrt{11}$ **B)** 4

C) 3 **D)** $2\sqrt{23}$

27. Consider a circle C which touches the y-axis at $(0, 6)$ and cuts off an intercept $6\sqrt{5}$ on the x-axis. Then the radius of the circle C is equal to:

A) $\sqrt{53}$ **B)** 9

C) 8 **D)** $\sqrt{82}$

28. A square is inscribed in the circle $x^2 + y^2 - 6x + 8y - 103 = 0$ with its sides parallel to the coordinate axes. Then the distance of the vertex of this square which is nearest to the origin is:

A) $\sqrt{137}$ **B)** 6

C) $\sqrt{41}$ **D)** 13

29. If the four distinct points $(4, 6)$, $(-1, 5)$, $(0, 0)$ and $(k, 3k)$ lie on a circle of radius r, then $10k + r^2$ is equal to

A) 34 **B)** 32

C) 35 **D)** 33

30. A square is inscribed in the circle $x^2 + y^2 - 10x - 6y + 30 = 0$. One side of this square is parallel to $y = x + 3(x_i, y_i)$ are the vertices of the square, then $\sum(x_i^2 + y_i^2)$ is equal to:

A) 152 **B)** 148

C) 156 **D)** 160

31. A rectangle is inscribed in a circle with a diameter lying along the line $3y = x + 7$. If the two adjacent vertices of the rectangle are $(-8, 5)$ and $(6, 5)$, then the area of the rectangle (in sq. units) is:

A) 72 **B)** 84

C) 56 **D)** 98

32. Four distinct points $(2k, 3k)$, $(1, 0)$, $(0, 1)$ and $(0, 0)$ lie on a circle for k equal to:

A) $\frac{3}{13}$ **B)** $\frac{2}{13}$

C) $\frac{5}{13}$ **D)** $\frac{1}{13}$

33. If a point P has coordinates $(0, -2)$ and Q is any point on the circle $x^2 + y^2 - 5x - y + 5 = 0$, then the maximum value of $(PQ)^2$ is:

A) $\frac{25 + \sqrt{6}}{2}$ **B)** $14 + 5\sqrt{3}$

C) $\frac{47 + 10\sqrt{6}}{2}$ **D)** $8 + 5\sqrt{3}$

34. The length of the diameter of the circle which touches the x-axis at the point $(1, 0)$ and passes through the point $(2, 3)$ is:

A) $\frac{10}{3}$ **B)** $\frac{3}{5}$

C) $\frac{6}{5}$ **D)** $\frac{5}{3}$

35. Let a circle C pass through the points $(4, 2)$ and $(0, 2)$, and its centre lie on $3x + 2y + 2 = 0$. Then the length of the chord of the circle C, whose mid-point is $(1, 2)$, is:

A) $4\sqrt{2}$ **B)** $2\sqrt{2}$

C) $2\sqrt{3}$ **D)** $\sqrt{3}$

36. If the area of an equilateral triangle inscribed in the circle $x^2 + y^2 + 10x + 12y + c = 0$ is $27\sqrt{3}$ sq units, then c is equal to:

A) 20 **B)** 25

C) 40 **D)** 13

37. If the lines $3x - 4y - 7 = 0$ and $2x - 3y - 5 = 0$ are two diameters of a circle of area 49π square units, then the equation of the circle is:

A) $x^2 + y^2 + 2x - 2y - 47 = 0$ **B)** $x^2 + y^2 + 2x - 2y - 62 = 0$

C) $x^2 + y^2 - 2x + 2y - 62 = 0$ **D)** $x^2 + y^2 - 2x + 2y - 47 = 0$

38. If one of the diameters of the circle, given by the equation, $x^2 + y^2 - 4x + 6y - 12 = 0$,is a chord of a circle S, whose centre is at $(-3, 2)$, then the radius of S is:

A) 5 **B)** 10

C) $5\sqrt{2}$ **D)** $5\sqrt{3}$

39. A line drawn through the point $P(4, 7)$ cuts the circle $x^2 + y^2 = 9$ at the points A and B. Then $PA \cdot PB$ is equal to:

A) 53 **B)** 56

C) 74 **D)** 65

40. If the length of the chord of the circle $x^2 + y^2 = r^2; (r > 0)$ along the line $y - 2x = 3$ is r, then r^2 is equal to:

A) $\frac{9}{5}$ **B)** $\frac{24}{5}$

C) $\frac{12}{5}$ **D)** 12

41. If d_1 and d_2 are the longest and shortest distances of $(-7, 2)$ from the curve whose equation is $x^2 + y^2 - 10x - 14y = 51$ then geometric mean of d_1 and d_2 is

A) $\sqrt{11}$ **B)** 7
C) 2 **D)** $2\sqrt{11}$

42. If the lines $2x - 3y + 6 = 0$ and $mx + 2y + 12 = 0$ meets the co-ordinate axes at concyclic points then $m =$

A) 3 **B)** -3
C) 2 **D)** -2

43. The point (1,4) lies inside the circle $x^2 + y^2 - 6x - 10y + p = 0$ which does not touch or intersects the coordinate axes then

A) $0 < p < 29$ **B)** $25 < p < 29$
C) $9 < p < 25$ **D)** $9 < p < 29$

44. The ΔPQR is inscribed in the circle $x^2 + y^2 = 25$. If Q and R have coordinates $(3, 4)$ and $(-4, 3)$respectively, then $\angle QPR$ is equal to

A) $\frac{\pi}{6}$ **B)** $\frac{\pi}{3}$
C) $\frac{\pi}{4}$ **D)** $\frac{\pi}{2}$

45. The circle $x^2 + y^2 = 4x + 8y + 5$ intersects the line $3x - 4y = m$ at two distinct points if

A) $-35 < m < 15$ **B)** $15 < m < 65$
C) $35 < m < 85$ **D)** $-85 < m < -35$

46. The radius of the largest circle passes through the points and always in the first Quadrant is

47. If P and Q are variable points on $C_1 : x^2 + y^2 = 4$ and $C_2 : x^2 + y^2 - 8x - 6y + 24 = 0$ respectively then maximum value of PQ is equal to

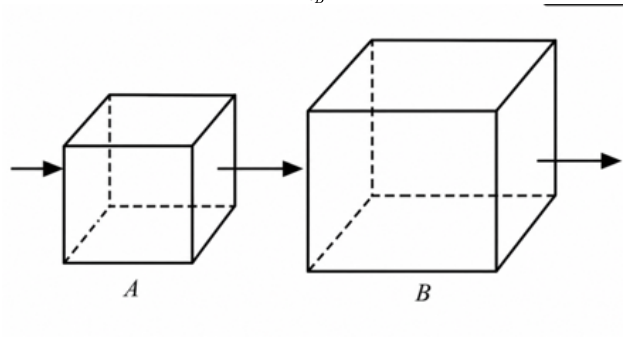
48. A circle C of radius unity lies in first quadrant and touches both the co-ordinate axes. If the radius of the circle which touches both co-ordinate axes and passes through centre of C has radius either r_1 or r_2 $(r_1 \neq r_2)$ then $\frac{|r_1 - r_2|}{\sqrt{2}}$ equals

49. All Circle(s) touching x-axis at a distance '3' units from the origin and having an intercept of length $2\sqrt{7}$ on y-axis is (are) drawn. A circle touching all the above circles is may have radius

50. The length of the diameter of the circle which touches the x-axis at the point $(1, 0)$ and passes through the point $(2, 3)$ is:

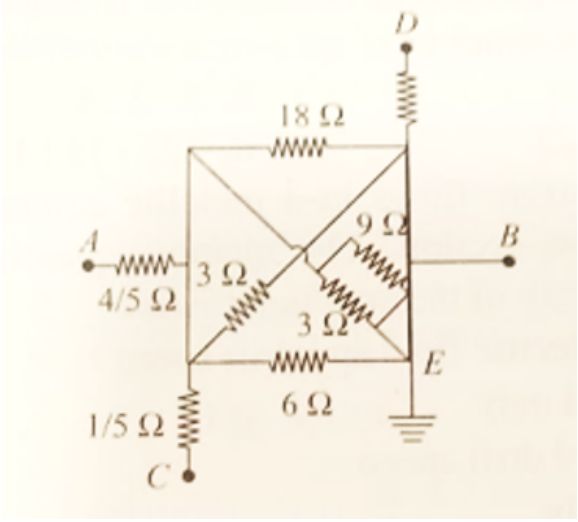
Physics

51. Two square metal plates A and B are of the same thickness and material. The side of B is twice that of A. These are connected .If R_A and R_B are the resistances of A and B, respectively, then $\frac{R_A}{R_B}$ is



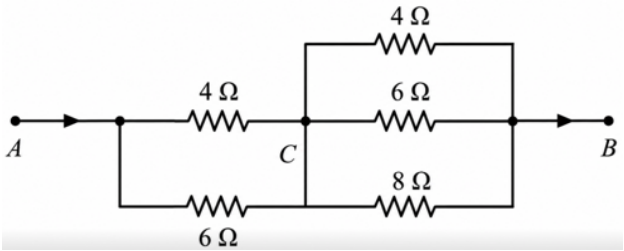
A) 1:2 **B)** 2:1
C) 1:1 **D)** 4:1

52. if a battery is connected between points A and B, e.m.f $E = 18$ V, the current flowing through the battery is



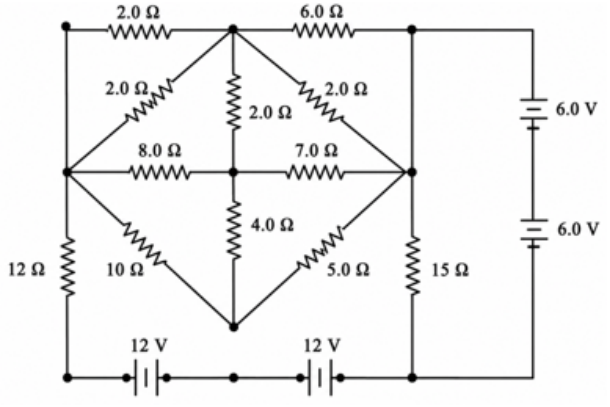
A) 10 A **B)** 20 A
C) 5 A **D)** 15 A

53. Five resistors are connected between points A and B. A current of 10 A flows from A tB. Which of the following is correct?



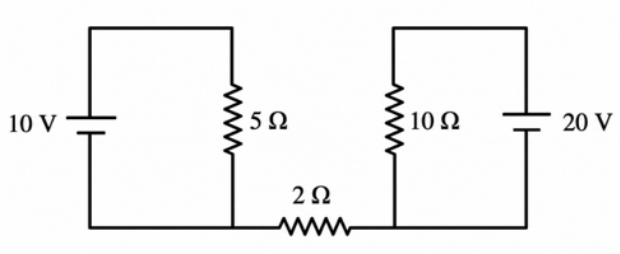
A) $V_{AC} = V_{CB}$ **B)** $V_{AC} > V_{CB}$
C) $V_{AC} < V_{CB}$ **D)** $V_{CB} = 24$ V

54. The current through the 8Ω resistor is..



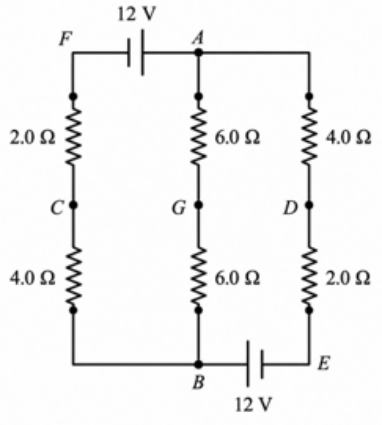
A) 4 A **B)** 2 A
C) zero **D)** 2.5 A

55. Find out the value of current through 2Ω resistance for the given circuit in



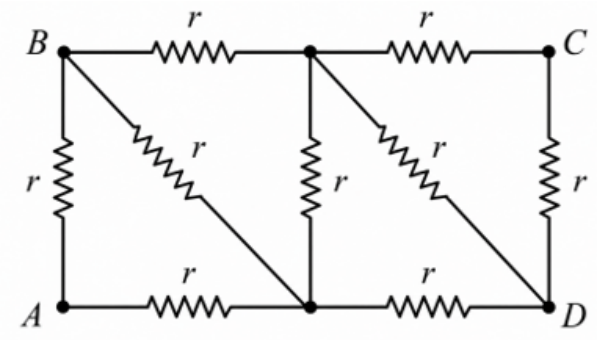
A) zero **B)** 2 A
C) 5 A **D)** 4 A

56. In the network the potential difference across A and B is



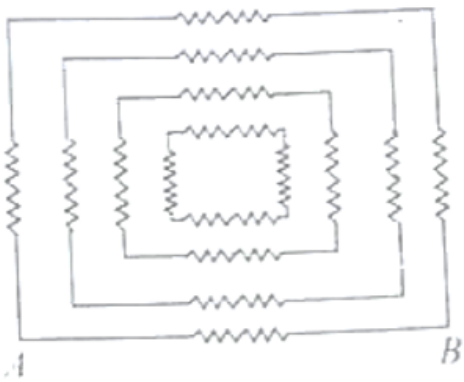
A) 6 V **B)** zero
C) 2 V **D)** 4 V

57. For the circuit the equivalent resistance between A and C is



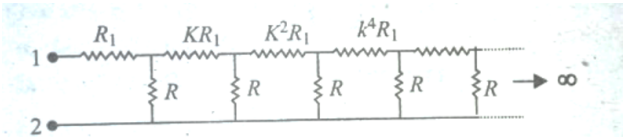
A) $\frac{12}{11}r$ **B)** $\frac{13}{11}r$
C) $\frac{14}{11}r$ **D)** $\frac{15}{11}r$

58. Sixteen resistors each of resistance 16Ω are connected in the circuit The net resistance between AB is



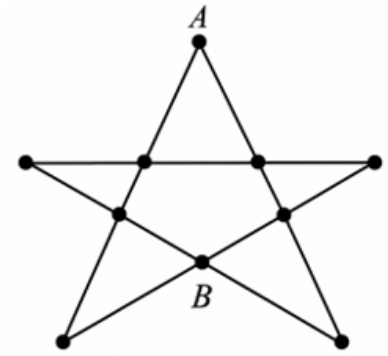
A) Ω **B)** 2Ω
C) 3Ω **D)** 4Ω

59. The circuit diagram shown in the consists of a large number of elements (each element has two resistors R_1 and R_2). The resistance of the resistors in each subsequent element differs by a factor of $k = \frac{1}{2}$ from the resistances of the resistors in the previous elements. The equivalent resistance between A and B,is.



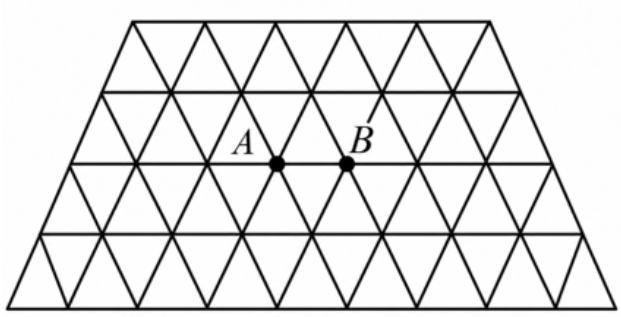
A) $\frac{R_1-R_2}{2}$ **B)** $\frac{(R_1-R_2)+\sqrt{R_1^2+R_2^2+6R_1R_2}}{2}$
C) $\frac{(R_1-R_2)+\sqrt{6R_1R_2}}{2}$ **D)** None of these

60. The resistance of all the wires between any two adjacent dots is R. The equivalent resistance between A and B is.



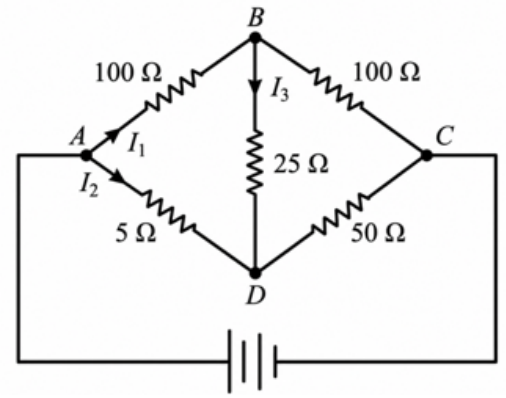
A) $\frac{7}{3}R$ **B)** $\frac{7}{6}R$
C) $\frac{14}{8}R$ **D)** None of these

61. There is an infinite wire grid with cells in the form of equilateral triangles. The resistance of each wire between neighbouring joint connections is R_0. The net resistance of the whole grid between the points A and B is.



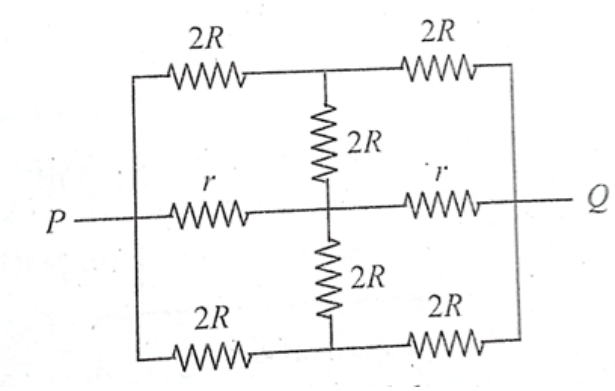
A) R_0 **B)** $\frac{R_0}{2}$
C) $\frac{R_0}{3}$ **D)** $\frac{R_0}{4}$

62. A Wheatstone bridge circuit. Which of the following correctly shows the currents I_1, I_2, and I_3 in the correct decreasing order of magnitude?



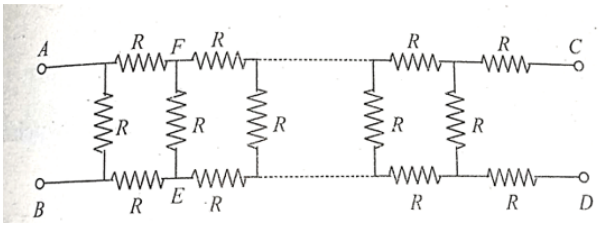
A) I_1, I_2, I_3
B) I_2, I_3, I_1
C) I_2, I_1, I_3
D) I_3, I_2, I_1

63. The effective resistance between point P and Q of the electrical circuit is.



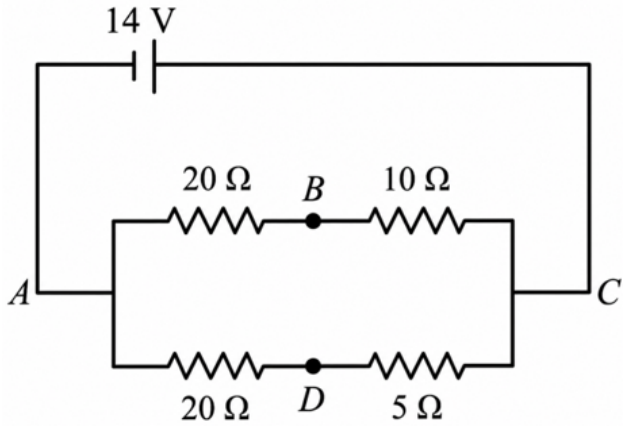
A) $\frac{2Rr}{R+r}$
B) $\frac{8R(R+r)}{3R+r}$
C) $2r + 4R$
D) $\frac{5R}{2} + 2r$

64. The value of resistors to be connected between C and D, so that the resistance of the entire circuit between A and B does not change with the number of elementary sets is



A) R
B) $R(\sqrt{3} - 1)$
C)
$3R3R$
D) $D)R(\sqrt{3} + 1)$

65. What resistor should be connected in parallel with the 20 Ω resistor in branch ADC in the circuit so that potential difference between B and D may be zero?

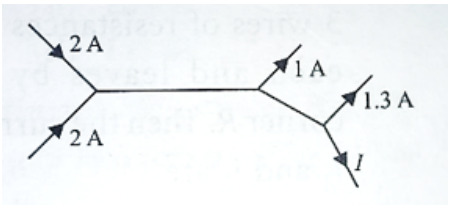


A) 20 Ω
B) 10 Ω
C) 5 Ω
D) 15 Ω

66. Point out the right statements about the validity of Kirchhoff's junction rule.

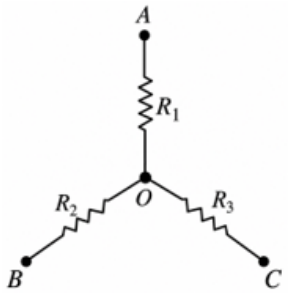
A) It is based on conservation of charge.
B) Outgoing currents add up and are equal to incoming currents at a junction.
C) Bending or reorienting the wire does not change the validity of Kirchhoff's junction rule.
D) All of these.

67. Figure shows currents in a part of an electric circuit, then current I is



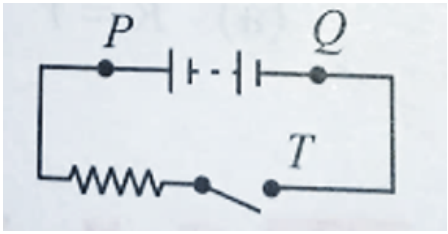
A) 1.7 A
B) 3.7 A
C) 1.3 A
D) 1 A

68. A circuit has a section ABC as shown in figure. If the potentials at points A, B and C are V_1, V_2 and V_3 respectively. The potential at point O is



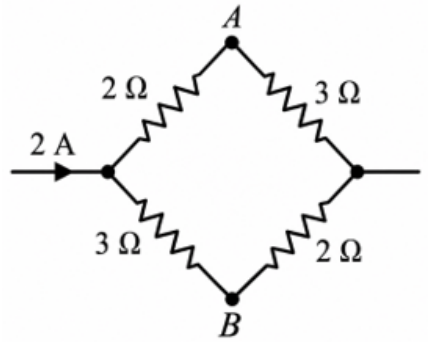
A) $V_1 + V_2 + V_3$
B) $\left[\frac{V_1}{R_1} + \frac{V_2}{R_2} + \frac{V_3}{R_3}\right]\left[\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}\right]^{-1}$
C) Zero
D) $\left[\frac{V_1}{R_1} + \frac{V_2}{R_2} + \frac{V_3}{R_3}\right](R_1 + R_2 + R_3)$

69. A battery, an open switch and a resistor are connected in series as shown in figure. Consider the following three statements concerning the circuit. A voltmeter will read zero if it is connected across points i) P and T ii) P and Q iii) Q and T Which one of the above is/are true?



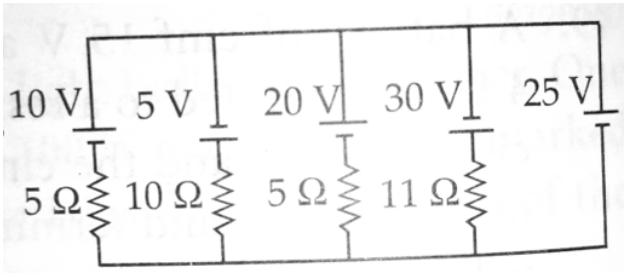
A) only (i) **B)** only (iii)
C) only (i) and (iii) **D)** (i), (ii) and (iii)

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



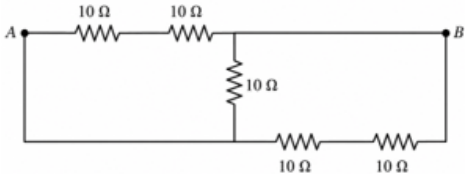
A) 1 V **B)** 2 V
C) 3 V **D)** 4 V

71. In the circuit shown, current flowing through 25V cell is (in Amperes)



72. Four resistances of $3\Omega, 3\Omega, 3\Omega$ and 4Ω respectively are used to form a Wheatstone bridge. The 4Ω resistance is short circuited with a resistance R in order to get bridge balanced. The value of R will be Option:

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



74. In a meter bridge experiment, the ratio of the left gap resistance to right gap resistance is 2 : 3, the balance point from left is

75. In a Wheatstone's network, $P = 2\Omega, Q = 2\Omega, R = 2\Omega$ and $S = 3\Omega$. The resistance with which S is to be shunted in order that the bridge may be balanced is

ANSWER KEY

Chemistry

1.	**3**	8.	**3**	15.	**4**	22.	**10**
2.	**4**	9.	**2**	16.	**3**	23.	**2**
3.	**4**	10.	**4**	17.	**4**	24.	**1**
4.	**3**	11.	**1**	18.	**2**	25.	**2**
5.	**4**	12.	**3**	19.	**3**		
6.	**3**	13.	**2**	20.	**1**		
7.	**1**	14.	**1**	21.	**6**		

Maths

26.	**4**	33.	**2**	40.	**3**	47.	**8**
27.	**2**	34.	**1**	41.	**4**	48.	**2**
28.	**3**	35.	**3**	42.	**2**	49.	**9 (or) 1**
29.	**3**	36.	**2**	43.	**2**	50.	$\frac{10}{3}$
30.	**1**	37.	**4**	44.	**3**		
31.	**2**	38.	**4**	45.	**1**		
32.	**3**	39.	**2**	46.	**1**		

Physics

51.	**3**	58.	**3**	65.	**1**	72.	**12**
52.	**1**	59.	**3**	66.	**4**	73.	**5**
53.	**2**	60.	**2**	67.	**1**	74.	**40**
54.	**3**	61.	**3**	68.	**2**	75.	**6**
55.	**1**	62.	**3**	69.	**3**		
56.	**2**	63.	**1**	70.	**1**		
57.	**4**	64.	**2**	71.	**11**		

SOLUTIONS

Q1.

Answer: C

Explanation:

S_N1 reactions proceed via the formation of a stable carbocation. Benzyl and allyl carbocations are resonance-stabilized, and tertiary carbocations are stabilized by inductive effects and hyperconjugation. $C_6H_5CH_2CH_2Cl$ would form a primary carbocation that lacks such stabilization.

Q2.

Answer: D

Explanation:
The reactivity towards an S_N1 mechanism is determined by the stability of the intermediate carbocation formed during the rate-determining step. 1-Bromo-1-phenylethane forms a secondary benzylic carbocation, which is highly stabilized by the resonance effect of the phenyl ring as well as the inductive and hyperconjugative effects of the methyl group.

Q3.

Answer: D

Explanation:

The reaction of -bromoanisole with sodamide ( ) involves an elimination-addition mechanism via a benzyne intermediate. The methoxy group directs the incoming nucleophile ( ) to the metaposition, resulting in 3-methoxyaniline as the product.

Q4.

Answer: C

Explanation:

This reaction is a nucleophilic substitution (S_N2) of a primary alkyl halide with a cyanide ion. S_N2 reactions are significantly accelerated in polar aprotic solvents like DMF because these solvents do not solvate the nucleophile, leaving it free to attack the substrate.

Q5.

Answer: D

Explanation:

Racemisation occurs during S_N1 hydrolysis if the starting material is an optically active alkyl halide. Among the choices, only compound (iv) possesses a chiral (asymmetric) carbon atom, allowing it to exist as enantiomers that form a racemic mixture upon reaction.

Q6.

Answer: C

Explanation:

Both reactions utilize isobutyl bromide, which is a primary (1°) alkyl halide. Primary alkyl halides predominantly undergo nucleophilic substitution via the S_N2 mechanism because they do not form stable carbocations for S_N1.

Q7.

Answer: A

Explanation:

Reactivity depends on the stability of the intermediate and the nature of the $C-X$ bond. Alkyl halides (III and IV) are more reactive than aryl halides (I and II) because aryl halides possess double bond character due to resonance. Among aryl halides, electron-withdrawing groups ($-NO_2$) increase reactivity (II > I). Among alkyl halides, tertiary substrates are more reactive than secondary ones via S_N1 (III > IV).

Q8.

Answer: C

Explanation:

The rate of hydrolysis of alkyl chlorides is relatively slow due to the moderate leaving ability of the chloride ion. Adding NaI introduces I^-, which is a superior nucleophile that rapidly replaces Cl^- to form an alkyl iodide (Finkelstein-like step). Because I^- is also an excellent leaving group, the intermediate alkyl iodide then undergoes much faster hydrolysis than the original chloride.

Q9.

Answer: B

Explanation:

The outcome of a reaction with KOH depends on the solvent. Aqueous KOHfavors substitution (S_N2/S_N1), while alcoholicKOHacts as a strong base and favors dehydrohalogenation (elimination). In option B, the tertiary alkyl halide reacts with alcoholicKOH to undergo E2 elimination, forming an alkene.

Q10.

Answer: D

Explanation:

The reaction involves a tertiary alkyl halide and a bulky base (potassium t-butoxide). Because the substrate is sterically hindered and the base is also extremely bulky, nucleophilic substitution (S_N2) is impossible. Instead, E2 elimination occurs exclusively.

Q11.

Answer: A

Explanation:

The reaction with acetate in acetic acid (a polar protic solvent) typically proceeds via an S_N1 mechanism. Therefore, the rate is determined by the stability of the carbocation. Allylic carbocations are resonance-stabilized, and the addition of electron-donating methyl groups further increases this stability.

Q12.

Answer: C

Explanation:

This is an electrophilic aromatic substitution (bromination). The carbonyl group of the valerophenone is a strongly deactivating group and acts as a meta-director. In the presence of a Lewis acid catalyst ( ), the bromine is directed to the metaposition of the benzene ring.

Q13.

Answer: B

Explanation:

reactivity at the benzylic position is enhanced by electron-withdrawing groups (EWG) on the aromatic ring. These groups stabilize the transition state by reducing electron density. The effect is strongest when the EWGs are at positions that can exert their or effects more effectively.

Q14.

Answer: A

Q15.

Answer: D

Explanation:

The mechanism is a concerted, one-step process involving a backside attack by the nucleophile. This results in the complete inversion of the spatial arrangement of groups around the asymmetric carbon atom.,

Q16.

Answer: C

Explanation:

Nucleophilicity is generally inversely proportional to electronegativity when comparing atoms within the same period of the periodic table. Carbon is the least electronegative among the choices and most readily shares its electron pair.,

Q17.

Answer: D

Q18.

Answer: B

Explanation:

The rate of S_N2 is influenced by both steric and electronic effects. Adjacent groups that stabilize the transition state or have strong electron-withdrawing properties can significantly accelerate the reaction.,

Q19.

Answer: C

Explanation:

In electrophilic aromatic substitution, bromine directs new groups to the ortho and para positions due to its mesomeric effect ($+M$). The para-isomer is the major product because it is less sterically hindered. However, the directing influence is always governed by the mesomeric effect, not the inductive effect.,

Q20.

Answer: A

Q21.

Answer: 6

Explanation:

(as provided in the document): [The document does not provide a text-based solution explanation for Question 8.]

Q22.

Answer: 10

Explanation:

[The document does not provide a text-based solution explanation for Question 9.]

Q23.

Answer: 2

Explanation:

(as provided in the document): The given reaction undergoes nucleophilic substitution by S_N2 mechanism at room temperature. $\therefore$ No. of π electrons present in $P = 2$.

Q24.

Answer: 1

Explanation:

(Provided in the document): Here only carbon 12th and 13th is not taking part in the resonance. All other carbons are taking part in resonance and lone pair of O is also taking part in the resonance. As because of resonance stability of compound increases Br will not attack to any carbon which is taking part in the resonance and decrease the stability of compound. So, Br can only attack 12 th carbon or 13 th carbon atom but 12th carbon is a alpha carbon and it can easily donate H^+ ion and add Br^- ion and increase stability.

Q25.

Answer: 2

Explanation:

The provided solution identifies the nature of the given groups regarding aromatic electrophilic substitution: $-OCH_3$ is a $(+M)$ group. $-N(H)COCH_3$ is a $(+M)$ group. $-N(H)CH_3$ is a $(+M)$ group. $-C \equiv N$ is a $(-M)$ group (deactivating). The carbonyl-containing group attached to the oxygen (appearing to be an ester/derivative) is identified as a $(-M)$ group (deactivating). Therefore, the total number of deactivating groups is 2.

Q26.

Answer: D

Explanation:

(Provide the same solution given in the document) The given circle is $x^2 + y^2 - 2gx + 6y - 19c = 0$ Its centre is $(g, -3)$ and radius is, $r = \sqrt{g^2 + 9 + 19c}$ Since the circle passes through $(6, 1)$, $(6 - g)^2 + (1 + 3)^2 = r^2; \Rightarrow (6 - g)^2 + 16 = g^2 + 9 + 19c;$ $\Rightarrow 36 - 12g + g^2 + 16 = g^2 + 9 + 19c$ $\Rightarrow 43 - 12g = 19c \quad \ldots (1)$ The centre $(g, -3)$ lies on the line $x - 2cy = 8, \Rightarrow g - 2c(-3) = 8, \Rightarrow g + 6c = 8 \quad \ldots (2)$ From (2), $c = \frac{8 - g}{6}$,Substituting in (1),$43 - 12g = \frac{19(8 - g)}{6}$, $\Rightarrow 258 - 72g = 152 - 19g, \Rightarrow 106 = 53g \Rightarrow g = 2$,Hence, $c = \frac{8 - 2}{6} = 1$,Therefore,$r^2 = g^2 + 9 + 19c = 4 + 9 + 19 = 32$ The distance of the centre from the x-axis is 3. Hence, the length of the intercept made by the circle on the x-axis is $2\sqrt{r^2 - 3^2} = 2\sqrt{32 - 9} = 2\sqrt{23}$

Q27.

Answer: B

Explanation:

Since the circle touches the y-axis at $(0, 6)$, its centre is $(r, 6)$ and its radius is r. The distance of the centre from the x-axis is 6. The length of the chord cut by the x-axis is $2\sqrt{r^2 - 6^2} = 6\sqrt{5}, \Rightarrow 2\sqrt{r^2 - 36} = 6\sqrt{5}$,x$\Rightarrow \sqrt{r^2 - 36} = 3\sqrt{5}, \Rightarrow r^2 - 36 = 45, \Rightarrow r^2 = 81, \Rightarrow r = 9$ Hence, the radius of the circle is 9.

Q28.

Answer: C

Explanation:
The eigen circle is x^2+y^2-6x+8y-103=0, $Completing the squares$,(x-3)^2+(y+4)^2=128$Hence, Centre$=(3,-4)$Radius$=\sqrt{128}=8\sqrt{2} $For a square inscribed in a circle with sides parallel to the coordinate axes, t$(3\pm 8,,-4\pm 8), $Thus the four vertices are$(11,4),\ (11,-12),\ (-5,4),\ (-5,-12)$Their distances from the origin are, For$(11,4), \sqrt{11^2+4^2}=\sqrt{137}, For(11,-12),\sqrt{11^2+(-12)^2}=\sqrt{265} For(-5,4),\sqrt{(-5)^2+4^2}=\sqrt{41}, For(-5,-12),\sqrt{(-5)^2+(-12)^2}=13$Hence, the nearest vertex is$(-5,4) $and its distance from the origin is$\sqrt{41}$

Q29.

Answer: C

Q30.

Answer: A

Q31.

Answer: B

Explanation:

Let the Adjacent vertices be A(-8,5)andB(6,5)$.
Hence,$AB = 6 - (-8) = 14$
Since the rectangle is inscribed in a circle, the centre of the circle is the intersection point of the diagonals of the rectangle. The midpoint of AB is$\left(\frac{-8+6}{2}, \frac{5+5}{2}\right) = (-1, 5)$,Let the other side length be h.Then the centre of the rectangle is$\left(-1, ; 5 \pm \frac{h}{2}\right)$;Since the diameter lies along the line,$3y = x + 7$,the centre lies on this line.
Substituting $x = -1, 3y = -1 + 7 = 6 \Rightarrow y = 2$Therefore,$5 - \frac{h}{2} = 2$,
$\Rightarrow \frac{h}{2} = 3, \Rightarrow h = 6$Hence, the area of the rectangle is$14 \times 6 = 84$.

Q32.

Answer: C

Explanation:

(Provide the same solution given in the document) Let the equation of the circle be $x^2 + y^2 + Dx + Ey + F = 0$,Since the circle passes through $(0, 0)$, $F = 0$,Using the point $(1, 0), 1 + D = 0, \Rightarrow D = -1$,Using the point $(0, 1), 1 + E = 0, \Rightarrow E = -1$ Hence, the equation of the circle is, $x^2 + y^2 - x - y = 0$ Since the point $(2k, 3k)$ also lies on the circle, $(2k)^2 + (3k)^2 - 2k - 3k = 0, \Rightarrow 4k^2 + 9k^2 - 5k = 0$
$\Rightarrow 13k^2 - 5k = 0, \Rightarrow k(13k - 5) = 0, \Rightarrow k = 0$ or $k = \frac{5}{13}$,As the four points are distinct, $(2k, 3k) \neq (0, 0)$. Hence,$k \neq 0$Therefore, $k = \frac{5}{13}$

Q33.

Answer: B

Explanation:

(Provide the same solution given in the document) The given circle is $x^2 + y^2 - 5x - y + 5 = 0$ Completing the squares, $\left(x - \frac{5}{2}\right)^2 + \left(y - \frac{1}{2}\right)^2 = \frac{3}{2}$ Hence, Centre $= \left(\frac{5}{2}, \frac{1}{2}\right)$,Radius $= \sqrt{\frac{3}{2}}$ Let the centre be C.The distance $PC = \sqrt{\left(\frac{5}{2}\right)^2 + \left(\frac{1}{2} + 2\right)^2}$,$= \sqrt{\frac{25}{4} + \frac{25}{4}}$,$= \sqrt{\frac{25}{2}} = \frac{5}{\sqrt{2}}$ The maximum distance from P to any point on the circle is$PQ_{\max} = PC + r$
$,= \frac{5}{\sqrt{2}} + \sqrt{\frac{3}{2}}$,$= \frac{5 + \sqrt{3}}{\sqrt{2}}$ Therefore,$(PQ)^2_{\max} = \left(\frac{5 + \sqrt{3}}{\sqrt{2}}\right)^2$,
$= \frac{25 + 3 + 10\sqrt{3}}{2}$,$= \frac{28 + 10\sqrt{3}}{2}$,$= 14 + 5\sqrt{3}$ Hence, the required maximum value is,$14 + 5\sqrt{3}$

Q34.

Answer: A

Explanation:

(Provide the same solution given in the document) Since the circle touches the x-axis at $(1, 0)$, its centre is $(1, r)$ where r is the radius. The circle passes through $(2, 3)$. Hence,$(2 - 1)^2 + (3 - r)^2 = r^2$,
$\Rightarrow 1 + (3 - r)^2 = r^2, \Rightarrow 1 + 9 - 6r + r^2 = r^2, \Rightarrow 10 = 6r \Rightarrow r = \frac{5}{3}$
,Therefore, the diameter is,$2r = 2 \times \frac{5}{3} = \frac{10}{3}$ Hence, the required length of the diameter is, $\frac{10}{3}$

Q35.

Answer: C

Explanation:

(Provide the same solution given in the document) The circle passes through the points $(4, 2)$ and $(0, 2)$. Hence, the centre lies on the perpendicular bisector of the chord joining these two points. The midpoint of the chord is $\left(\frac{4+0}{2}, \frac{2+2}{2}\right) = (2, 2)$ Since the chord is horizontal, its perpendicular bisector is$x = 2$ The centre also lies on,
$3x + 2y + 2 = 0$Substituting $x = 2, 6 + 2y + 2 = 0 \Rightarrow 2y = -8$,
$\Rightarrow y = -4$ Hence, the centre is$(2, -4)$ The radius is
$r = \sqrt{(4-2)^2 + (2+4)^2} = \sqrt{4 + 36} = 2\sqrt{10}$ The given chord has midpoint $(1, 2)$.Therefore, the perpendicular distance from the centre to this chord is $d = \sqrt{(2-1)^2 + (-4-2)^2} = \sqrt{1 + 36} = \sqrt{37}$,The length of the chord is $2\sqrt{r^2 - d^2} = 2\sqrt{40 - 37}$,$= 2\sqrt{3}$ Hence, the required length of the chord is$2\sqrt{3}$

Q36.

Answer: B

Q37.

Answer: D

Explanation:

(Provide the same solution given in the document) The centre of the circle is the point of intersection of the two diameters. Solve$3x - 4y - 7 = 0$, $2x - 3y - 5 = 0$,From the second equation,$6x - 9y - 15 = 0$ From the first equation,$6x - 8y - 14 = 0$,Subtracting,$-y - 1 = 0$,
$\Rightarrow y = -1$ Substituting in$2x - 3(-1) - 5 = 0, \Rightarrow 2x - 2 = 0$
$\Rightarrow x = 1$ Hence, the centre is$(1, -1)$,The area of the circle is $\pi r^2 = 49\pi, \Rightarrow r = 7$ Therefore, the equation of the circle is $(x - 1)^2 + (y + 1)^2 = 49$ Expanding,$x^2 + y^2 - 2x + 2y + 2 = 49$,
$\Rightarrow x^2 + y^2 - 2x + 2y - 47 = 0$ Hence, the required equation is $x^2 + y^2 - 2x + 2y - 47 = 0$

Q38.

Answer: D

Explanation:

The given circle is,

$$x^2 + y^2 + 4x + 6y - 12 = 0$$

Completing the squares,$(x - 2)^2 + (y + 3)^2 = 25$ Hence, Centre $= (2, -3)$Radius $= 5$,Therefore, one of its diameters has length $2 \times 5 = 10$,This diameter is a chord of circle S. The midpoint of the chord is the centre of the given circle, $(2, -3)$The centre of circle S is, $(-3, 2)$ The distance between the centre of S and the chord is $d = \sqrt{(2+3)^2 + (-3-2)^2}$,$= \sqrt{25 + 25} = 5\sqrt{2}$,If R is the radius of circle S, then$\left(\frac{10}{2}\right)^2 + d^2 = R^2, \Rightarrow 5^2 + (5\sqrt{2})^2 = R^2$,
$\Rightarrow 25 + 50 = R^2 \Rightarrow R^2 = 75, \Rightarrow R = 5\sqrt{3}$,Hence, the required radius is$5\sqrt{3}$

Q39.

Answer: B

Explanation:

The Given circle is, $x^2 + y^2 = 9$,Its centre is,$(0, 0)$and radius is,$r = 3$,The point is$P(4, 7)$.The power of the point P with respect to the circle is $PA \cdot PB = OP^2 - r^2$,Now,$OP^2 = 4^2 + 7^2 = 16 + 49 = 65$ Therefore,$PA \cdot PB = 65 - 9 = 56$Hence, the required value is,56

Q40.

Answer: C

Explanation:

The circle is $x^2+y^2=r^2$,Its centre is,$(0,0)$,and radius is$r$. The given line is,$y-2x-3=0$ The perpendicular distance from the centre to the line is$d=\dfrac{|0-0-3|}{\sqrt{(-2)^2+1^2}}=\dfrac{3}{\sqrt{5}}$ The length of the chord is,$2\sqrt{r^2-d^2}$ Since the chord length is given as r,$2\sqrt{r^2-\dfrac{9}{5}}=r$ Squaring both sides,$4\left(r^2-\dfrac{9}{5}\right)=r^2,\Rightarrow 4r^2-\dfrac{36}{5}=r^2,\Rightarrow 3r^2=\dfrac{36}{5}$, $\Rightarrow r^2=\dfrac{12}{5}$ Hence, the required value is $\frac{12}{5}$

Q41.

Answer: D

Explanation:

The explanation provided in the document (page 1) is as follows: $\sqrt{d_1d_2}=\sqrt{(CP-r)(CP+r)}=\sqrt{CP^2-r^2}$, $=\sqrt{169-125}=2\sqrt{11}$

Q42.

Answer: B

Explanation:

The explanation provided in the document (page 2) is as follows: If the lines $a_1x+b_1y+c_1=0$ and $a_2x+b_2y+c_2=0$ meets the axes in concyclic points then $a_1a_2=b_1b_2$

Q43.

Answer: B

Explanation:

The circle is given by $x^2+y^2-6x-10y+p=0$. Comparing this with the general form $x^2+y^2+2gx+2fy+c=0$, we get the center $C=(-g,-f)=(3,5)$ and the radius $r=\sqrt{g^2+f^2-c}=\sqrt{3^2+5^2-p}=\sqrt{9+25-p}=\sqrt{34-p}$. 1. Point (1,4) inside the circle: The distance CP must be less than the radius r. $CP=\sqrt{(3-1)^2+(5-4)^2}=\sqrt{2^2+1^2}=\sqrt{5}$. Condition: $CP<r\Rightarrow CP^2<r^2\Rightarrow 5<34-p\Rightarrow p<29$. 2. Does not touch or intersect the coordinate axes: For a circle with center $(3,5)$ in the first quadrant to not intersect the axes, its radius r must be less than the distance to the nearest axis. The distance to the y-axis is 3 and to the x-axis is 5. Thus, $r<3$. $r^2<9\Rightarrow 34-p<9\Rightarrow p>25$. Combining these, $25<p<29$.

Q44.

Answer: C

Explanation:

The explanation provided in the document (page 1) is as follows: $m_1=\text{slope of }OP=\frac{4}{3}$ and $m_2=\text{slope of }OQ=\frac{-3}{4}$ $\Rightarrow m_1m_2=-1\Rightarrow\angle QOP=\frac{\pi}{2}$ Thus $\angle QPR=\frac{\pi}{4}$

Q45.

Answer: A

Explanation:

Use $\perp$ dist. From centre < radius $\Rightarrow\ \frac{|10+m|}{5}<5\Rightarrow -35<m<15$

Q46.

Answer: 1

Explanation:

The explanation provided in the document is as follows: Equation of the circle: $(x-1)(x-2)+(y-1)(y-2)+\lambda(x-y)=0$ $r=\sqrt{\frac{(3-\lambda)^2}{2}+(\frac{3+\lambda}{2})^2-4}$ The largest circle is possible if it touches the x-axes or y-axes: $\frac{-3+\lambda}{2}+\frac{3+\lambda}{2}=0\Rightarrow r=1$

Q47.

Answer: 8

Explanation:

Centre of first circle $=(0,0)=O$. Radius $r_1=2$. Centre of 2^{nd} circle $=(4,3)=A$. Radius $r_2=\sqrt{4^2+3^2-24}=\sqrt{16+9-25}=1$. Distance between centres $OA=\sqrt{4^2+3^2}=\sqrt{16+9}=5$. Maximum distance $PQ=OA+r_1+r_2=5+2+1=8$.

Q48.

Answer: 2

Explanation:

The circle C has radius 1 and touches both axes in the first quadrant, so its center is $(1,1)$. Let a circle with radius r touch both coordinate axes in the first quadrant; its center must be (r,r). This circle passes through $(1,1)$, so the distance between (r,r) and $(1,1)$ must equal the radius r: $\sqrt{(r-1)^2+(r-1)^2}=r\ \sqrt{2(r-1)^2}=r\ \sqrt{2}|r-1|=r$ Squaring both sides: $2(r-1)^2=r^2\Rightarrow 2(r^2-2r+1)=r^2\Rightarrow r^2-4r+2=0$. The roots r_1,r_2 are $\frac{4\pm\sqrt{16-8}}{2}=2\pm\sqrt{2}$. Then $|r_1-r_2|=|(2+\sqrt{2})-(2-\sqrt{2})|=2\sqrt{2}$. $\frac{|r_1-r_2|}{\sqrt{2}}=\frac{2\sqrt{2}}{\sqrt{2}}=2$.

Q49.

Answer: 9 (or) 1

Explanation:

Centre $=(\pm3,\pm4)$, radius $=4$. There are four such circles. All these circles may be tangent to a circle whose radius may be 5 ± 4 i.e., 1 (or) 9 .

Q50.

Answer: $\frac{10}{3}$

Explanation:

Since the circle touches the x-axis at $(1,0)$, its center must be at $(1,r)$ or $(1,-r)$, where r is the radius. The equation of the circle is $(x-1)^2+(y-r)^2=r^2$. Since it passes through $(2,3)$, we have $(2-1)^2+(3-r)^2=r^2$, which simplifies to $1+9-6r+r^2=r^2$, giving $10=6r$, or $r=\frac{5}{3}$. The diameter is $2r=\frac{10}{3}$.

Q51.

Answer: C

Explanation:
Resistance R is given by $R=\rho\frac{l}{A_{cross}}$. Since both plates are squares of the same thickness t and material ρ, the length l in the direction of current flow is equal to the side length s, and the cross-sectional area A_{cross} is $s\times t$. Thus, $R=\rho\frac{s}{s\times t}=\frac{\rho}{t}$. Since ρ and t are constant for both, $R_A=R_B$.

Q52.

Answer: A

Explanation:
The circuit consists of a network of resistors. By simplifying the circuit, the equivalent resistance R_{eq} between terminals A and B is found. Using Ohm's Law $I=\frac{E}{R_{eq}}$, the total current is determined.

Q53.

Answer: B

Explanation:
The circuit consists of two parallel branches connected between points A and B. The top branch has resistors 4Ω, 6Ω, and 8Ω in series, totaling 18Ω. The bottom branch has resistors 4Ω and 6Ω in series, totaling 10Ω. Since the voltage drop across parallel branches is equal, we compare the potential drops across segments AC and CB. In the top branch, the resistance from A to C is 4Ω, and from C to B is $(6\Omega+8\Omega)=14\Omega$.

Q54.

Answer: C

Explanation:
By examining the circuit diagram we can identify a bridge configuration. The arrangement of the resistors in the central part of the circuit satisfies the condition for a balanced Wheatstone bridge. Because the ratios of the resistances in the opposite arms are equal, the potential difference across the central 8Ω resistor is zero. Consequently, no current flows through it.

Q55.

Answer: A

Explanation:
The potential difference between the points connected to the 2Ω resistor is such that the current is zero. Since the potentials at both ends of the 2Ω resistor are equal, no current flows through it.

Q56.

Answer: B

Explanation:
The circuit is composed of two parallel branches connected to the points A and B. By analyzing the structure, we can determine the potential at point A and point B. Due to the symmetric distribution of resistances and identical voltage sources ($12\ \mathrm{V}$) connected to the branches, the potential at node A is equal to the potential at node B. Therefore, the potential difference $V_{AB} = V_A - V_B = 0\ \mathrm{V}$.

Q57.

Answer: D

Explanation:
The circuit represents a symmetrical network of resistors, each of value r. By applying the principle of symmetry (nodes B and D are at the same potential when current flows from A to C), the network can be simplified by shorting nodes B and D. This reduction leads to the equivalent resistance $R_{AC} = \frac{15}{11}r$.

Q58.

Answer: C

Explanation:

$R_{AB} = \frac{3R}{16} = \frac{3(16)}{16} = 3\Omega$,$3\Omega$ between points A and B.

Q59.

Answer: C

Explanation:

The circuit is an infinite ladder network where each stage has resistors that scale by a factor $k = \frac{1}{2}$. By defining the equivalent resistance of the entire infinite network as R_{eq} and setting up a recurrence relation where the addition of another identical stage maintains the same total resistance, one can derive the value of R_{eq} by solving the resulting quadratic equation.

Q60.

Answer: B

Explanation:

The circuit represents a network of resistors R arranged in a pattern of equilateral triangles. By applying the principles of symmetry and nodal potential analysis, current paths are identified. Since the network is symmetric with respect to the line passing through A and B, the current distribution allows the circuit to be simplified into a series-parallel combination, yielding an equivalent resistance of $R_{eq} = \frac{7}{6}R$.

Q61.

Answer: C

Explanation:

By considering the infinite symmetry of the equilateral triangular grid, if a current I enters at point A, it distributes symmetrically into the six surrounding paths. Due to the infinite nature of the grid, the resistance between any two adjacent nodes is effectively $R_0/3$ when considering the superposition of all paths leading to infinity.

Q62.

Answer: C

Explanation:

By applying Kirchhoff's Laws to the unbalanced Wheatstone bridge, we calculate the node potentials. The current I_2 flows through the branch with the lowest resistance (5Ω), making it the largest. I_1 flows through the 100Ω arm, and I_3 is the current through the central 25Ω galvanometer/resistor branch. Comparing these calculated values confirms the order $I_2 > I_1 > I_3$.

Q63.

Answer: A

Explanation:

The circuit consists of a symmetric bridge-like structure where each arm is composed of resistors R and r. By identifying the nodes that are at the same potential due to the symmetry of the circuit, the bridge can be simplified into a parallel combination of two branches, each containing resistors in series, resulting in the effective resistance $R_{eq} = \frac{2Rr}{R+r}$.

Q64.

Answer: B

Explanation:

The circuit an infinite ladder network of resistors R.For the total resistance of the circuit to remain constant regardless of the number of stages added, the equivalent resistance R_{eq} of the network must satisfy a self-similar condition. By analyzing the network and setting up the recurrence relation $R_{eq} = R + \frac{R \cdot R_{eq}}{R+R_{eq}}$, the value of the required resistor configuration is found.

Q65.

Answer: A

Explanation:

For the potential difference between points B and D to be zero, the bridge must be balanced. In a balanced Wheatstone bridge, the ratio of the resistances in the two branches connected to the common terminal must be equal.The circuit can be viewed as two parallel branches connected across the 14 V source: Branch ABC: Consists of 20 Ω and 10 Ω resistors in series. Branch ADC: Consists of the 20 Ω resistor (with a parallel resistor R added) and the 5 Ω resistor in series. For the potential at B to equal the potential at D ($V_B = V_D$), the Wheatstone bridge balance condition requires: $\frac{R_{AB}}{R_{BC}} = \frac{R_{AD}}{R_{DC}}$

Q66.

Answer: D

Explanation:

Kirchhoff's junction rule is a statement of the conservation of electric charge. Since charge cannot accumulate at a junction in a steady state, the sum of currents entering a junction must equal the sum of currents leaving it, regardless of the physical orientation of the wires.

Q67.

Answer: A

Explanation:

By applying Kirchhoff's First Law (Junction Rule) sequentially at each junction, we can determine the unknown current. The sum of currents entering a node equals the sum of currents leaving it.

Q68.

Answer: B

Explanation:

Using the nodal analysis method based on Kirchhoff's Junction Rule, the sum of currents leaving node O must be zero. Expressing currents in terms of potential differences and resistances allows us to solve for the node potential V_0.

Q69.

Answer: C

Explanation:

In a series circuit with an open switch, the circuit is incomplete, and no current can flow through the components, meaning the current $I = 0$. According to Ohm's Law, the potential difference across any resistor is $V = I \times R$; since I is zero, the voltage across the resistor (points P and T) is also zero. According to the specified correct answer, the reading across points Q and T (the open switch) is also considered to be zero in this context.

Q70.

Answer: A

Explanation:

The network consists of two parallel branches between the left and right terminals. The upper branch has resistance $2\Omega + 3\Omega = 5\Omega$, and the lower branch has resistance $3\Omega + 2\Omega = 5\Omega$. Since both branches have equal resistance, the given current of $2\ \mathrm{A}$ divides equally, so each branch carries $1\ \mathrm{A}$. The potential drop from the left terminal to point A is $2\ \mathrm{V}$, while the drop to point B is $3\ \mathrm{V}$. Hence, the potential difference between A and B is $1\ \mathrm{V}$.

Q71.

Answer: 11

Explanation:

The total current drawn from the25V source is the algebraic sum of the currents flowing into the four parallel branches. For each branch, the current is determined by the net potential difference (source voltage adjusted for branch battery polarity) divided by the branch resistance. In branch 4, the battery polarity is reversed relative to the25V source, meaning their potentials add up.

Q72.

Answer: 12

Explanation:

A Wheatstone bridge is balanced when the ratio of the resistances in its four arms satisfies the condition $\frac{P}{Q} = \frac{R}{S'}$. Given that the first three arms are 3Ω, the fourth arm must have an effective resistance (S') of3Ω to maintain the ratio. Connecting a resistor R in parallel (shunting) with the 4Ω resistor allows the effective resistance of that arm to be reduced to the necessary value.

Q73.

Answer: 5

Explanation:

The left vertical wire makes the lower junction electrically the same as point A, and the right vertical wire makes the upper junction electrically the same as point B. Thus, the circuit reduces to three parallel branches between A and B: Top branch: two 10Ω resistors in series $\Rightarrow 20\Omega$Middle branch: one 10Ω resistor Bottom branch: two 10Ω resistors in series $\Rightarrow 20\Omega$ The equivalent resistance is obtained by combining these three parallel branches.

Q74.

Answer: 40

Explanation:

A meter bridge operates on the principle of a balanced Wheatstone bridge, where the ratio of the resistances in the two gaps is equal to the ratio of the lengths of the wire segments on either side of the balance point. The fundamental equation is $\frac{R_1}{R_2} = \frac{l}{100-l}$, where l is the length from the left end in centimeters.

Q75.

Answer: 6

Explanation:

For a Wheatstone bridge to be balanced, the ratio of resistances in adjacent arms must be equal ($P/Q = R/S$). If the current value of S makes the bridge unbalanced, we add a parallel resistance (shunt) to S to reach the required balanced value.