Max Marks: 300 **SR_WEEK-3 (29-06-2026)** **Time: 180 mins**

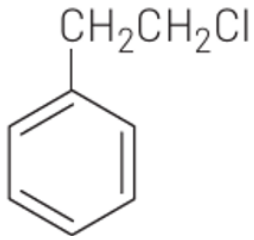
Chemistry

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

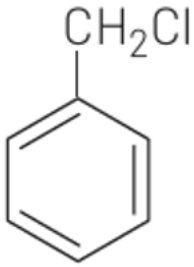
A) $CH_2 = CH - CH_2Cl$

B) $(CH_3)_3CCl$

C)

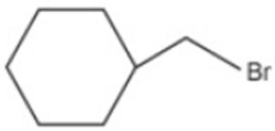


D)

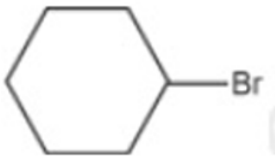


2. The compound that will undergo S_N1 reaction with the fastest rate is:

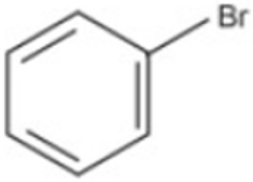
A)



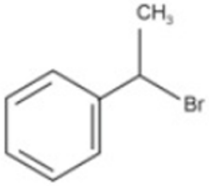
B)



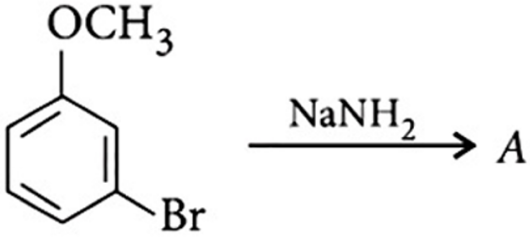
C)



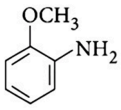
D)



3. Identify A and predict the type of reaction.

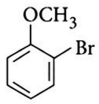


A)



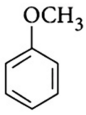
and elimination addition reaction

B)



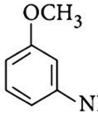
and cine substitution reaction

C)



and cine substitution

D)



and substitution reaction

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

A) ethanol

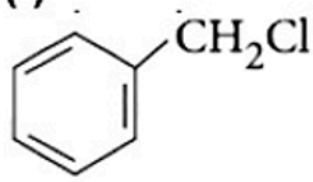
B) methanol

C) N,N'-dimethylformamide (DMF)

D) water

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

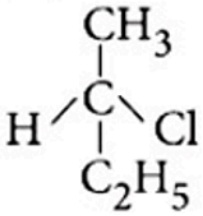
(i)



(ii) $CH_3CH_2CH_2Cl$

(iii) $H_3C-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2Cl$

(iv)



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

6. The mechanisms of reactions (i)

$(CH_3)_2CH-CH_2Br \xrightarrow{C_2H_5OH} (CH_3)_2CH-CH_2OC_2H_5+HBr$

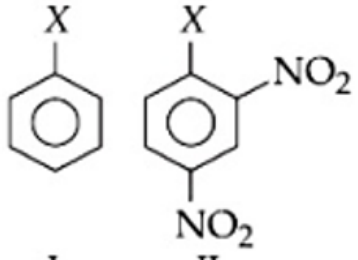
and (ii)

$(CH_3)_2CH-CH_2Br \xrightarrow{C_2H_5O^-} (CH_3)_2CH-CH_2OC_2H_5+Br^-$

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 II

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

III IV

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

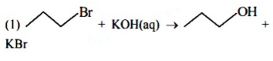
A) I < II < IV < III **B)** II < III < I < IV
C) IV < III < I < II **D)** III < II < I < IV

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.

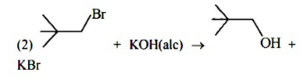
A) A is false but R is true **B)** A is true but R is false
C) Both A and R are true and R is the correct explanation of A **D)** Both A and R are true but R is NOT the correct explanation of A

9. Identify the incorrect option from the following:

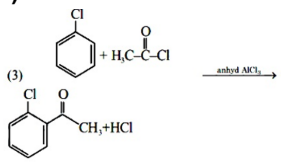
A)



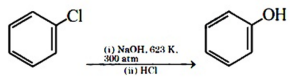
B)



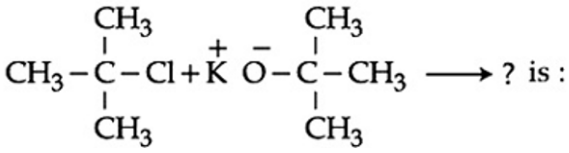
C)



D)



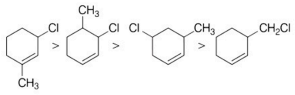
10. The major product in the reaction:



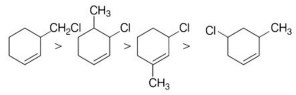
A) But-1-ethyl ether **B)** 2,2-Dimethyl butane
C) 2-Methyl pent-1-ene **D)** 2-Methyl prop-1-ene

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

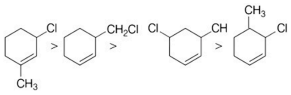
A)



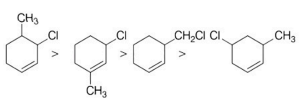
B)



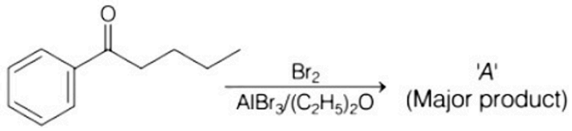
C)



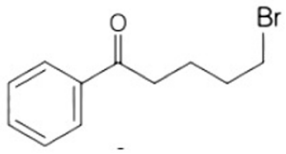
D)



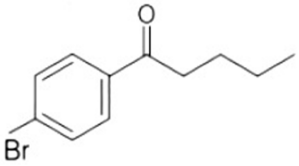
12. Consider the given reaction, the product A is



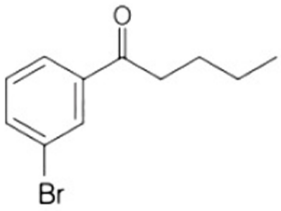
A)



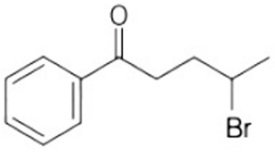
B)



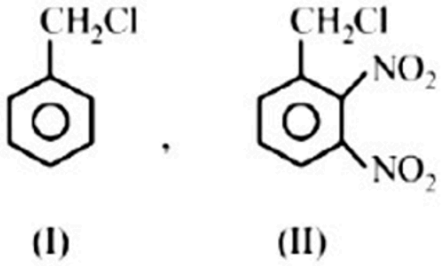
C) C)



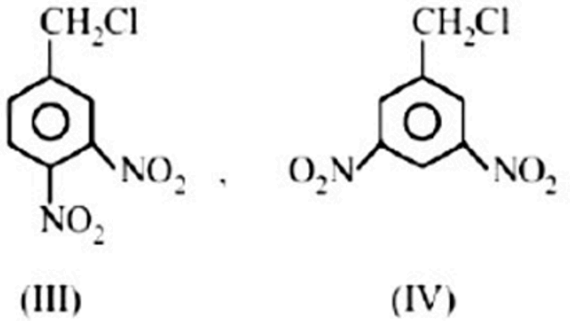
D)



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



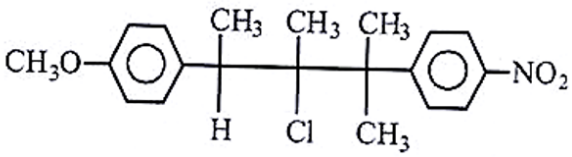
(I) (II)



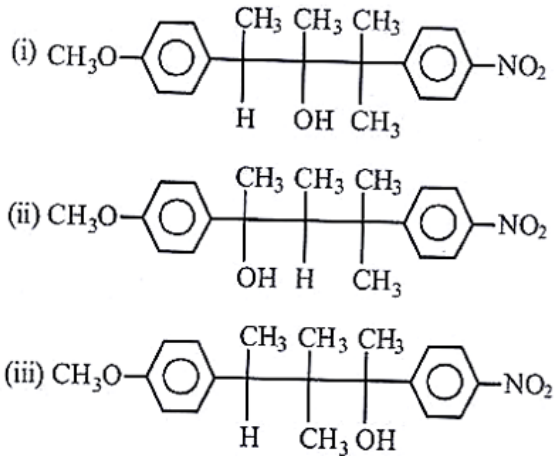
(III) (IV)

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)

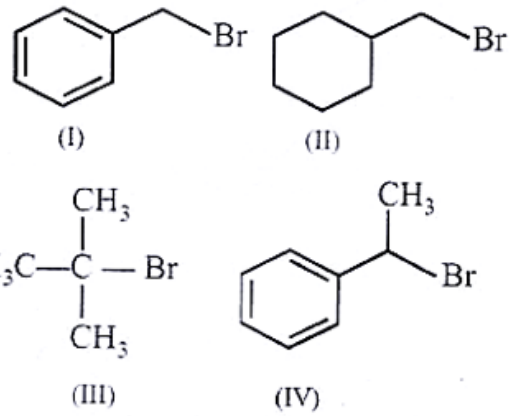
15. An reaction at an asymmetric carbon of a compound always gives:

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^-

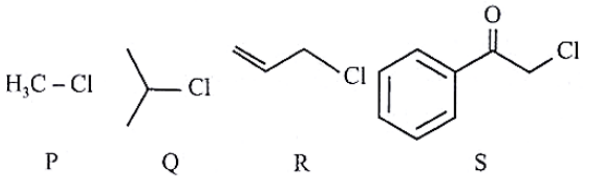
17. For the following compounds, the correct statement(s) with respect to nucleophilic substitution reaction is(are):



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

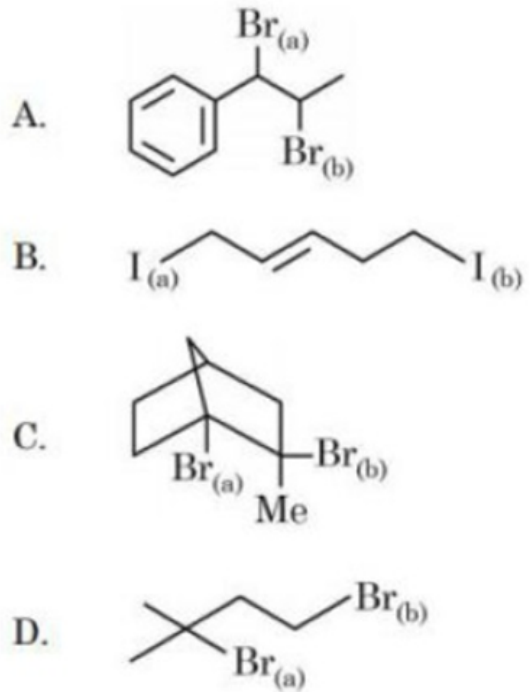
A) Both are correct, and Statement-2 is the correct explanation of Statement-1

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

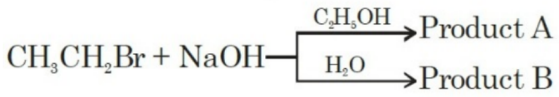
20. Choose the halogen which is most reactive towards S_N1 reaction in the given compounds (A, B, C, & D).



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

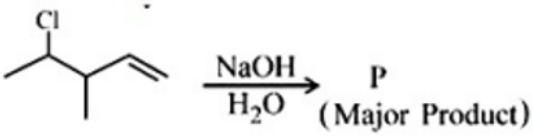
22.



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.

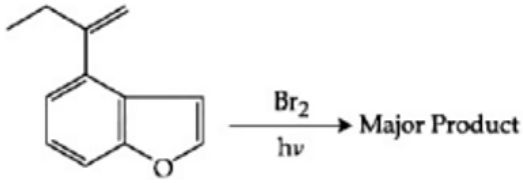
23.



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

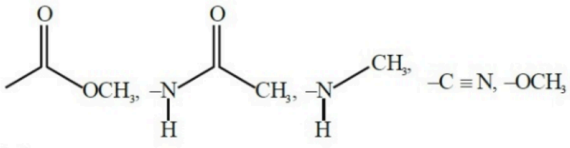
_____

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 four distinct points $(6,0)$, $(0,8)$, $(0,0)$, and $(k,2k)$ lie on a circle of radius r, then the value of $2k + r^2$ is equal to:

A) 27 **B)** 29
C) 31 **D)** 25

27. If the four distinct points $(4,0)$, $(0,4)$, $(0,0)$, and $(k,3k)$ lie on a circle of radius r, then the value of $10k + r^2$ is equal to:

A) 14 **B)** 24
C) 18 **D)** 20

28. Four distinct points $(1,0)$, $(0,1)$, $(0,0)$, and $(2k,3k)$ lie on a circle of radius r. Then the value of $13k+r^2$ is equal to:

A) 5.5 **B)** 6.5
C) 4.5 **D)** 7.5

29. Let the equation of the circle, which touches the x-axis at the point $(a,0)$, $a>0$ and cuts off an intercept of length b on the y-axis be $x^2+y^2-\alpha x+\beta y+\gamma=0$. If the circle lies above the x-axis, then the ordered pair $(2a,b^2)$ is equal to:

A) $(\alpha,\beta^2+4\gamma)$ **B)** $(\alpha,\beta^2-4\gamma)$
C) $(\gamma,\beta^2-4\alpha)$ **D)** $(\gamma,\beta^2+4\alpha)$

30. Let the equation of the circle, which touches the y-axis at the point $(0,a)$, $a>0$ and cuts off an intercept of length b on the x-axis be $x^2+y^2-\alpha x-\beta y+\gamma=0$. If the circle lies to the right of the y-axis, then the ordered pair $(2a,b^2)$ is equal to:

A) $(\beta,\alpha^2+4\gamma)$ **B)** $(\alpha,\beta^2-4\gamma)$
C) $(\beta,\alpha^2-4\gamma)$ **D)** $(\gamma,\alpha^2-4\beta)$

31. Equations of two diameters of a circle are $x+y=3$ and $2x-y=3$. A line joining the points $A(-1,-2)$ and $B(3,6)$ touches the circle at exactly one point $P(\alpha,\beta)$. Then, the value of $7\beta-4\alpha$ is equal to:

A) 4 **B)** 6
C) 8 **D)** 10

32. Let the abscissae of the points P and Q be the roots of $x^2-2x-3=0$ and the ordinates be the roots of $y^2+6y-4=0$. If PQ is a diameter of the circle $x^2+y^2+2ax+2by+c=0$, then the value of $(2a-2b+c)$ is:

A) -1 **B)** -15
C) 1 **D)** 3

33. A circle touches the x-axis at $(5,0)$ and makes an intercept of length 10 on the y-axis. This circle passes through the point:

A) $(5,12)$ **B)** $(2,5)$
C) $(5,10)$ **D)** $(1,5)$

34. A circle touches the y-axis at $(0,4)$ and makes an intercept of length 6 on the x-axis. This circle passes through the point:

A) $(5,4)$ **B)** $(9,4)$
C) $(4,5)$ **D)** $(4,9)$

35. A circle touches the x-axis at $(-2,0)$ and cuts off an intercept of length $4\sqrt{3}$ on the y-axis. This circle passes through the point:

A) $(-2,2)$ **B)** $(-2,8)$
C) $(2,-2)$ **D)** $(-4,4)$

36. A circle passes through the points $(1,2)$ and $(3,4)$. If its centre lies on the line $x+y=5$, then its radius is equal to:

A) $\sqrt{2}$ **B)** 2
C) $\sqrt{5}$ **D)** 1

37. A circle passes through the points $(0,1)$ and $(2,3)$. If its centre lies on the line $3x+4y=11$, then its radius is equal to:

A) $\sqrt{5}$ **B)** 2
C) $\sqrt{2}$ **D)** $\sqrt{10}$

38. 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)** $\frac{5}{3}$

39. A circle touches the y-axis at the point $(0,2)$ and passes through the point $(-1,1)$. The equation of the circle also passes through which of the following points?

A) $(-4,2)$ **B)** $(-2,4)$
C) $(2,-4)$ **D)** $(1,-1)$

40. The point diametrically opposite to the point $P(2,3)$ on the circle $x^2+y^2-4x-6y+11=0$ is:

A) $(2,3)$ **B)** $(0,0)$
C) $(2,-3)$ **D)** $(-2,-3)$

41. The differential equation of the family of circles with fixed radius 3 units and centre on the line $x=4$ is:

A) $(x-4)^2(y')^2=9-(x-4)^2$ **B)** $(x-4)^2(y')^2=9-(y-4)^2(y')^2$
C) $(x-4)^2(y')^2=9-(y-4)^2$ **D)** None of these

42. If the equation of the circumcircle of the triangle formed by the lines $L_1\equiv x-y=0$, $L_2\equiv 2x-y+3=0$, and $L_3\equiv x+2y-1=0$ is given by $\lambda_1L_1L_2+\lambda_2L_2L_3+\lambda_3L_3L_1=0$, then the value of $\frac{\lambda_1}{\lambda_3}+\frac{\lambda_2}{\lambda_1}$ is:

A) -2 **B)** $-\frac{11}{10}$
C) $\frac{1}{2}$ **D)** $-\frac{3}{5}$

43. If the circumcircle equation of a triangle bounded by $L_1 \equiv x + 2y = 0$, $L_2 \equiv x - y + 1 = 0$, and $L_3 \equiv 3x + y - 2 = 0$ is formulated as $\lambda_1 L_1 L_2 + \lambda_2 L_2 L_3 + \lambda_3 L_3 L_1 = 0$, then the ratio $\frac{\lambda_1}{\lambda_2}$ equals:

A) $\frac{7}{4}$ **B)** $-\frac{5}{2}$

C) $\frac{4}{7}$ **D)** 2

44. If the equation of the circle passing through the points $(0, 0)$, $(2, 0)$, and $(0, 4)$ is $ax^2 + ay^2 - 4x - 8y = 0$, then $a =$

A) 1 **B)** 2

C) -1 **D)** -2

45. The equation of a circle passing through the point $(-2, 1)$ and touching both the coordinate axes is:

A) $x^2 + y^2 + 2x - 2y + 1 = 0$ **B)** $x^2 + y^2 + 10x - 10y + 25 = 0$

C) $x^2 + y^2 - 2x + 2y + 1 = 0$ **D)** $x^2 + y^2 + 6x - 6y + 9 = 0$

46. The equations of two diameters of a circle are $x - 2y = 1$ and $2x + y = 7$. The line joining the points $A(-2, 5)$ and $B(4, 2)$ is a tangent intersecting the circle at the point $P(\alpha, \beta)$. Then, $5\alpha + 10\beta$ is equal to:

47. The equations of two diameters of a circle are $3x + y = 5$ and $x - y = -1$. The line joining $A(-3, 4)$ and $B(5, 0)$ is tangent to the circle at the point $P(\alpha, \beta)$. The value of $5(\alpha + \beta)$ is:

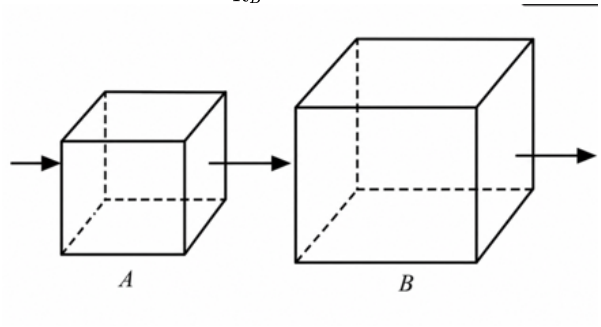
48. Let the abscissae of the two points P and Q on a circle be the roots of $x^2 - 6x - 8 = 0$ and the ordinates of P and Q be the roots of $y^2 - 4y - 5 = 0$. If PQ is a diameter of the circle $x^2 + y^2 + 2ax + 2by + c = 0$, then the value of $(a + b - c)$ is:

49. If the equation of the circle passing through the points $(1, 0)$, $(0, 1)$, and $(1, 2)$ is $ax^2 + ay^2 + 2gx + 2fy - 1 = 0$, then $a =$

50. Let the abscissae of the two points P and Q on a circle be the roots of $2x^2 - 8x - 5 = 0$ and the ordinates of P and Q be the roots of $y^2 + 4y - 6 = 0$. If PQ is a diameter of the circle $2(x^2 + y^2) + 2ax + 2by + c = 0$, then the value of $(a + b - c)$ is:

Physics

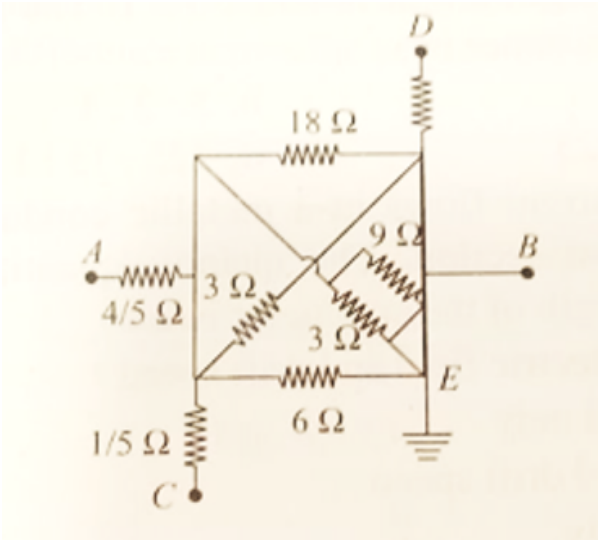
51. Two square metal plates A and B are of the same thickness and material. The side of B is twice that of A. These are connected .If R_A and R_B are the resistances of A and B, respectively, then $\frac{R_A}{R_B}$ is



A) 1:2 **B)** 2:1

C) 1:1 **D)** 4:1

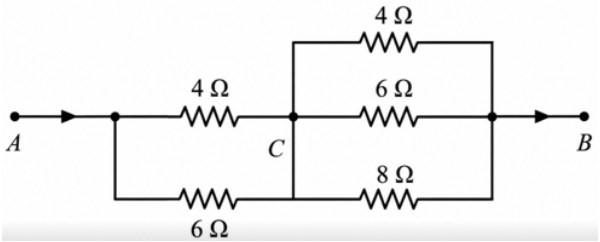
52. if a battery is connected between points A and B, e.m.f $E = 18$ V, the current flowing through the battery is



A) 10 A **B)** 20 A

C) 5 A **D)** 15 A

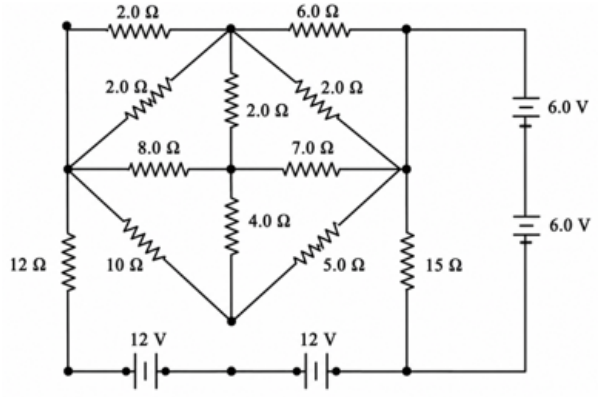
53. Five resistors are connected between points A and B. A current of 10 A flows from A tB. Which of the following is correct?



A) $V_{AC} = V_{CB}$ **B)** $V_{AC} > V_{CB}$

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

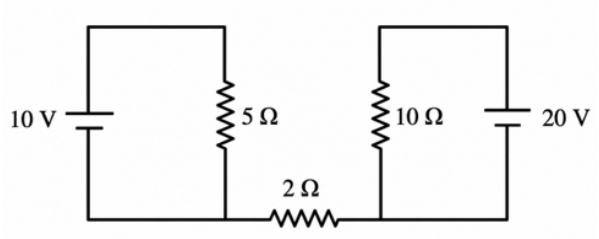
54. The current through the 8Ω resistor is..



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

C) zero **D)** $2.5\ \mathrm{A}$

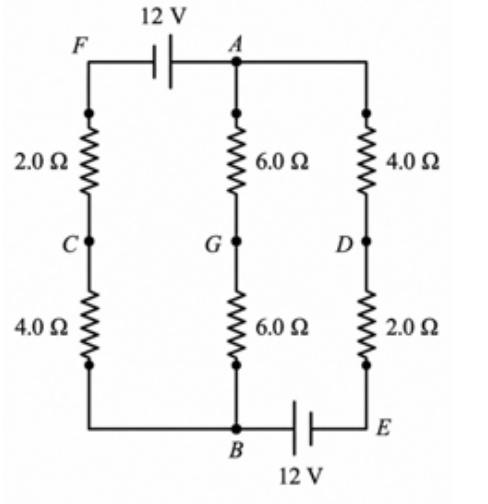
55. Find out the value of current through 2Ω resistance for the given circuit in



A) zero **B)** $2\ \mathrm{A}$

C) $5\ \mathrm{A}$ **D)** $4\ \mathrm{A}$

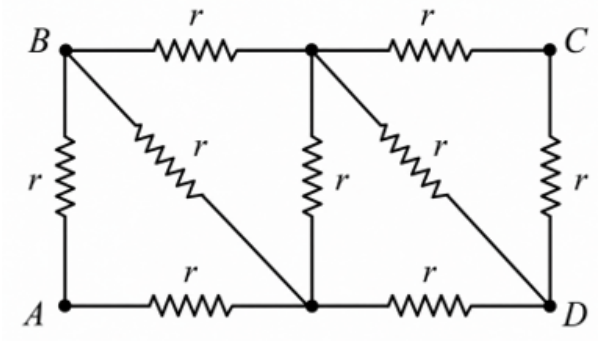
56. In the network the potential difference across A and B is



A) $6\ \mathrm{V}$ **B)** zero

C) $2\ \mathrm{V}$ **D)** $4\ \mathrm{V}$

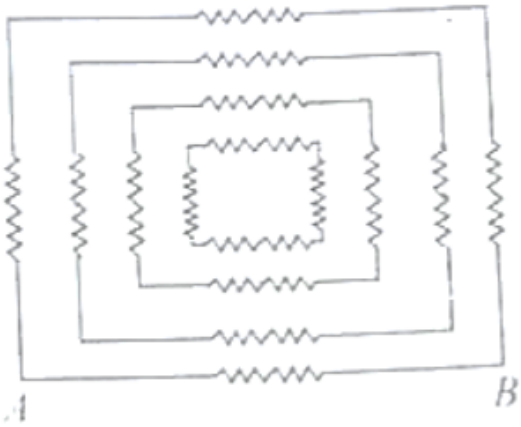
57. For the circuit the equivalent resistance between A and C is



A) $\frac{12}{11}r$ **B)** $\frac{13}{11}r$

C) $\frac{14}{11}r$ **D)** $\frac{15}{11}r$

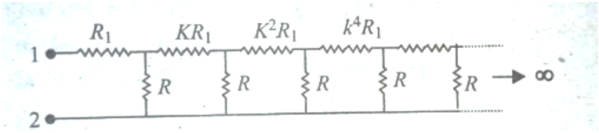
58. Sixteen resistors each of resistance 16Ω are connected in the circuit The net resistance between AB is



A) Ω **B)** 2Ω

C) 3Ω **D)** 4Ω

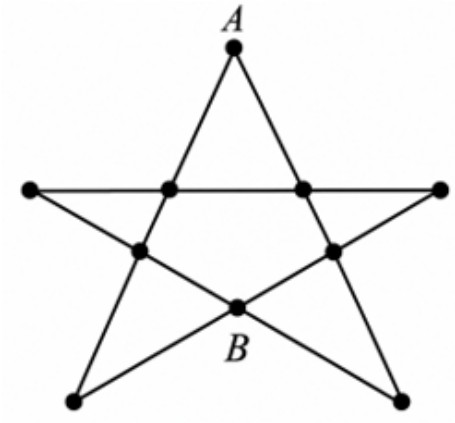
59. The circuit diagram shown in the consists of a large number of elements (each element has two resistors R_1 and R_2). The resistance of the resistors in each subsequent element differs by a factor of $k = \frac{1}{2}$ from the resistances of the resistors in the previous elements. The equivalent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

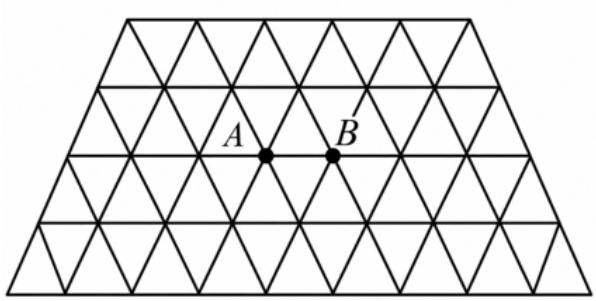
60. The resistance of all the wires between any two adjacent dots is R. The equivalent resistance between A and B is.



A) $\frac{7}{3}R$ **B)** $\frac{7}{6}R$

C) $\frac{14}{8}R$ **D)** None of these

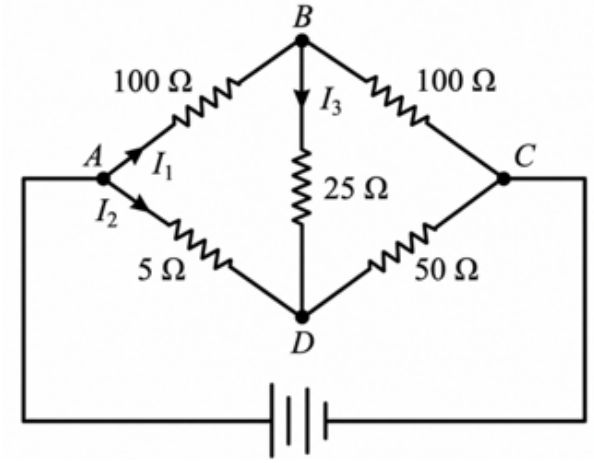
61. There is an infinite wire grid with cells in the form of equilateral triangles. The resistance of each wire between neighbouring joint connections is R_0. The net resistance of the whole grid between the points A and B is.



A) R_0 **B)** $\frac{R_0}{2}$

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

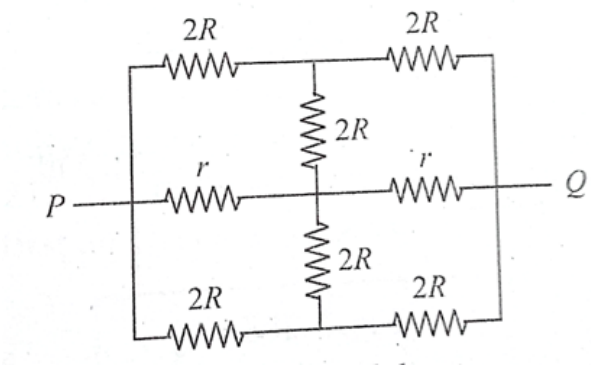
62. A Wheatstone bridge circuit. Which of the following correctly shows the currents I_1, I_2, and I_3 in the correct decreasing order of magnitude?



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

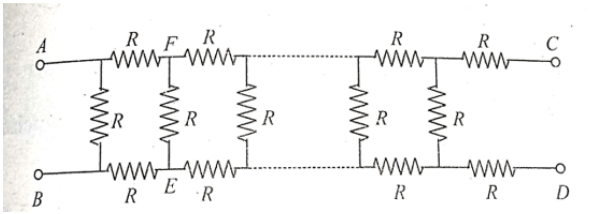
63. The effective resistance between point P and Q of the electrical circuit is.



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

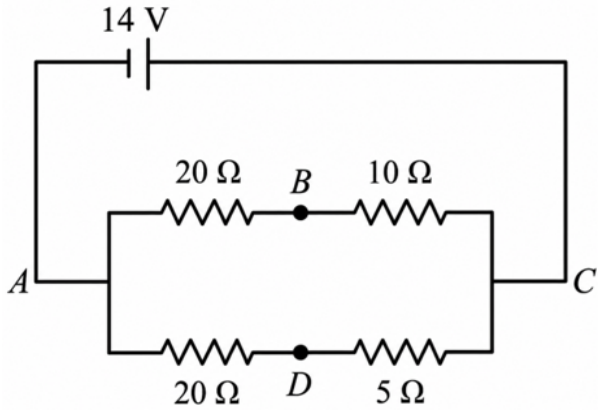


A) R **B)** $R(\sqrt{3}-1)$

C) **D)** $D)R(\sqrt{3}+1)$

$3R3R$

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.

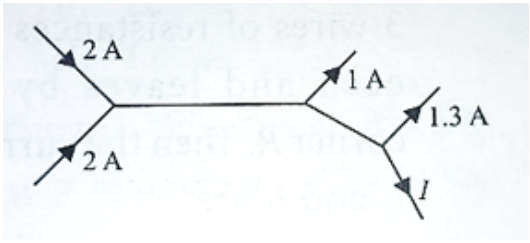
A) It is based on conservation of charge.

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



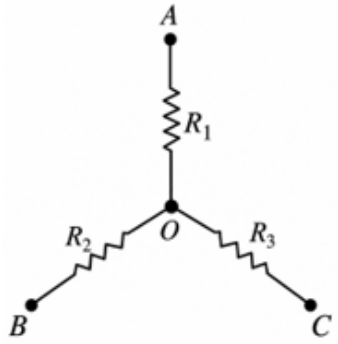
A) 1.7 A

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



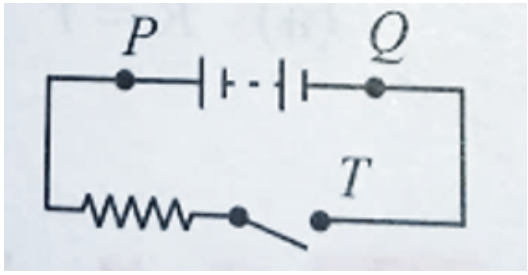
A) $V_1 + V_2 + V_3$

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?



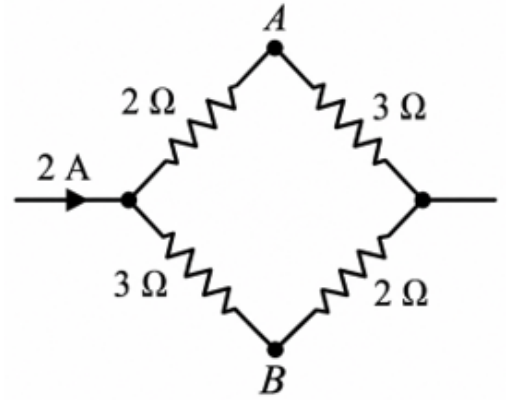
A) only (i)

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



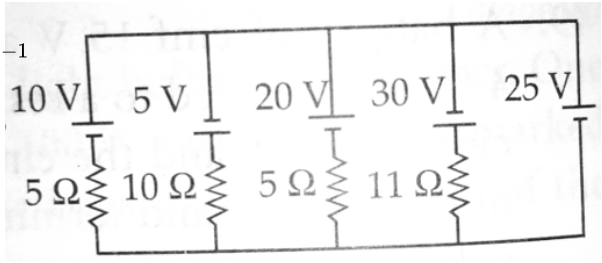
A) 1 V

B) 2 V

C) 3 V

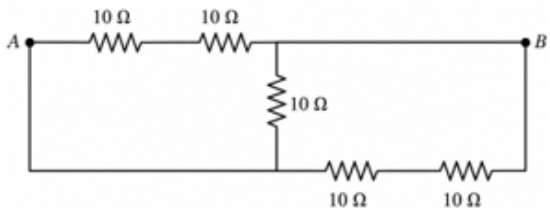
D) 4 V

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.	**2**	33.	**1**	40.	**1**	47.	**13**
27.	**2**	34.	**1**	41.	**1**	48.	**8**
28.	**1**	35.	**4**	42.	**2**	49.	**1**
29.	**2**	36.	**1**	43.	**1**	50.	**17**
30.	**3**	37.	**3**	44.	**2**		
31.	**3**	38.	**1**	45.	**1**		
32.	**2**	39.	**1**	46.	**40**		

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: B

Q27.

Answer: B

Q28.

Answer: A

Q29.

Answer: B

Explanation:

By Pythagoras theorem, the radius squared is given by $r^2 = a^2 + \frac{b^2}{4}$. The equation of the circle with center (a, r) is $(x-a)^2 + (y-r)^2 = r^2$. Expanding this gives $x^2 + y^2 - 2ax - 2ry + a^2 = 0$. Comparing with the general equation $x^2 + y^2 - \alpha x + \beta y + \gamma = 0$ gives $-\alpha = -2a \implies \alpha = 2a$, $\beta = -2r \implies \beta^2 = 4r^2$, and $\gamma = a^2$. Substituting these into the intercept relation yields $b^2 = \beta^2 - 4\gamma$.

Q30.

Answer: C

Explanation:

By Pythagoras theorem, the radius relation is $r^2 = a^2 + \frac{b^2}{4}$. The circle touches the y-axis at $(0, a)$ and lies to the right, so its center is (r, a). The equation of the circle is $(x-r)^2 + (y-a)^2 = r^2 \implies x^2 + y^2 - 2rx - 2ay + a^2 = 0$. Comparing with $x^2 + y^2 - \alpha x - \beta y + \gamma = 0$ gives $\alpha = 2r \implies \alpha^2 = 4r^2$, $\beta = 2a$, and $\gamma = a^2$. Substituting these into the intercept formula results in $b^2 = \alpha^2 - 4\gamma$.

Q31.

Answer: C

Explanation:

The center of the circle is found by intersecting the two given diameters. Since the line joining A and B intersects the circle at only one point, it forms a tangent to the circle at the point of contact $P(\alpha, \beta)$. The normal line CP connects the center C to P and is perpendicular to the tangent line AB. Solving the system of equations of the tangent line and the normal line gives the coordinates of P.

Q32.

Answer: B

Explanation:

The sums and products of roots derived from the quadratic expressions determine the standard expanded form of the circle on diameter PQ. Comparing this result with the general equation yields the exact values for a, b, and c.

Q33.

Answer: A

Explanation:

When a circle touches the x-axis at a point $(h, 0)$, its center lies on the vertical line $x = h$, making its coordinates (h, k). The radius of such a circle is equal to the absolute value of the y-coordinate of its center, i.e., $R = |k|$. The length of the intercept cut off by the circle on the y-axis is given by the formula $2\sqrt{k^2 - c}$, which allows us to find the value of k and establish the equation of the circle.

Q34.

Answer: A

Explanation:

By symmetry, if a circle touches the y-axis at $(0, 4)$, its center lies on the horizontal line $y = 4$, giving it the coordinates $(h, 4)$, and its radius is $R = |h|$. The length of the intercept made on the x-axis is given by $2\sqrt{h^2 - c}$, which helps find the value of h.

Q35.

Answer: D

Explanation:

When the circle touches the x-axis at $(-2, 0)$, its center is located at $(-2, k)$ and its radius is $R = |k|$. The y-intercept relation $2\sqrt{k^2 - c} = 4\sqrt{3}$ enables calculation of the variable parameter k.

Q36.

Answer: A

Explanation:

Let the centre of the circle be $C(\alpha, \beta)$. Since the centre lies on the line $x + y = 5$, we have $\alpha + \beta = 5 \implies \beta = 5 - \alpha$. The distance from the centre to the given points $A(1, 2)$ and $B(3, 4)$ must be equal to the radius ($CA = CB$). Equating the squared distances helps solve for the coordinates of the centre, from which the radius can be directly computed.

Q37.

Answer: C

Explanation:

Let the centre be $C(\alpha, \beta)$ lying on $3x + 4y = 11$. By equating the squared distances from C to $A(0, 1)$ and $B(2, 3)$, we obtain a linear relationship between α and β. Solving the simultaneous linear equations gives the unique center of the circle, which is then used to find the radius.

Q38.

Answer: A

Explanation:

Since the circle touches the x-axis at $(1, 0)$, its centre must lie on the line perpendicular to the x-axis at that point, meaning its x-coordinate is 1. The equation of such a circle can be represented in terms of an unknown parameter λ as $(x-1)^2 + y^2 + \lambda y = 0$. Substituting the given passing point $(2, 3)$ lets us find λ, which helps determine the radius and consequently the diameter of the circle.

Q39.

Answer: A

Explanation:

When a circle touches the y-axis at $(0, 2)$, its centre lies on the horizontal line $y = 2$, making the equation take the form $x^2 + (y-2)^2 + \lambda x = 0$. Substituting the point $(-1, 1)$ establishes the value of λ. Once the equation is fully constructed, the options are checked by substitution to find the correct passing point.

Q40.

Answer: A

Explanation:

The given circle is $x^2 + y^2 - 4x - 6y + 11 = 0$. By comparing it with the general equation of a circle, we find the centre to be $(2, 3)$. Since the given point $P(2, 3)$ itself coincides with the centre of the circle, the radius is 0 (a point circle), meaning any point diametrically opposite to it at a distance of $2r$ remains at the same coordinates.

Q41.

Answer: A

Explanation:

Since the centre lies on the vertical line $x = 4$, the coordinates of the centre can be represented as $(4, k)$. With a fixed radius of 3 units, the family of circles is represented by $(x-4)^2 + (y-k)^2 = 9$. We eliminate the arbitrary constant k by differentiating with respect to x to form the differential equation.

Q42.

Answer: B

Explanation:

The equation of the circumcircle passing through the vertices of the triangle formed by three lines $L_1 = 0, L_2 = 0, L_3 = 0$ can be written as: $\lambda_1 L_1 L_2 + \lambda_2 L_2 L_3 + \lambda_3 L_3 L_1 = 0$ By setting the coefficient of xy to 0 and equating the coefficient of x^2 to the coefficient of y^2, we determine the proportional relations between the parameters λ_1, λ_2, and λ_3.

Q43.

Answer: A

Explanation:

Applying the circle constraints on the second-degree curve equation $\lambda_1 L_1 L_2 + \lambda_2 L_2 L_3 + \lambda_3 L_3 L_1 = 0$, the xy term vanishes ($\text{Coeff of } xy = 0$) and the primary quadratic term coefficients match ($\text{Coeff of } x^2 = \text{Coeff of } y^2$). Solving this system of equations isolates the structural ratio $\frac{\lambda_1}{\lambda_2}$.

Q44.

Answer: B

Explanation:

The given equation represents a circle that passes through three distinct points. By substituting the non-origin coordinates into the general equation, we generate independent conditions that allow us to cleanly isolate and solve for the scaling coefficient a.

Q45.

Answer: A

Explanation:

Since the circle touches both coordinate axes and passes through a point $(-2, 1)$ located in the second quadrant, its center must lie in the second quadrant. The coordinates of the center can be assumed as $(-r, r)$, where r is the radius of the circle. By setting up the standard equation of the circle and substituting the given point, we can solve for r.

Q46.

Answer: 40

Explanation:
The intersection of the two diameters yields the center C. The line connecting A and B intersects the circle at exactly one point, meaning it is a tangent line. The line CP is perpendicular to AB and passes through the center C. Finding the intersection of lines AB and CP gives $P(\alpha, \beta)$.

Q47.

Answer: 13

Explanation:

The center of the circle is determined by finding the intersection of its two diameters. Since the line AB touches the circle at only one point, it acts as a tangent. The normal line CP passes through the center and is perpendicular to AB. The intersection of AB and CP gives $P(\alpha, \beta)$.

Q48.

Answer: 8

Explanation:

When the coordinates of the endpoints of a diameter $P(x_1, y_1)$ and $Q(x_2, y_2)$ are given, the equation of the circle can be written using the diametric form:
$(x - x_1)(x - x_2) + (y - y_1)(y - y_2) = 0$ Expanding this gives:
$x^2 - (x_1 + x_2)x + x_1x_2 + y^2 - (y_1 + y_2)y + y_1y_2 = 0$
Using the properties of the given quadratics, we determine the sums and products of the roots to construct the circle's equation and extract the coefficients.

Q49.

Answer: 1

Explanation:

Since the circle passes through $(1, 0)$, $(0, 1)$, and $(1, 2)$, their coordinates must satisfy the equation $ax^2 + ay^2 + 2gx + 2fy - 1 = 0$. By substituting these points, we get a system of linear equations that can be solved simultaneously to eliminate g and f, leaving the value of a.

Q50.

Answer: 17

Explanation:

In this scenario, the quadratic for the abscissae has a leading coefficient of 2. We use the standard formulas for sum and product of roots, adjust the diametric circle form accordingly by multiplying the entire equation to align with the form $2(x^2 + y^2) \ldots$, and compare the parameters.

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.