Max Marks: 720 **SR_WEEK-3 (02-07-2026)** **Time: 180 mins**

Physics

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

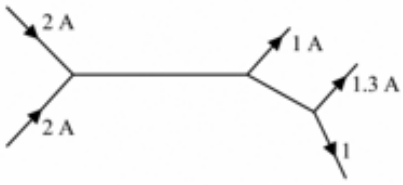
A) It is based on conservation of charge.

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.

2. Figure shows currents in a part of an electric circuit,



then current I is

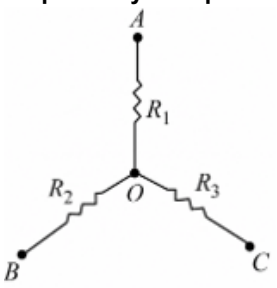
A) 1.7 A

B) 3.7 A

C) 1.3 A

D) 1 A

3. 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



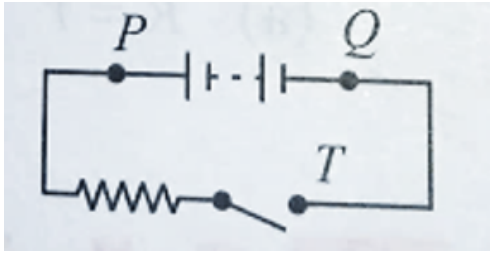
A) $V_1 + V_2 + V_3$

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) $\left[\frac{V_1}{R_1} + \frac{V_2}{R_2} + \frac{V_3}{R_3}\right](R_1 + R_2 + R_3)$

4. 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?

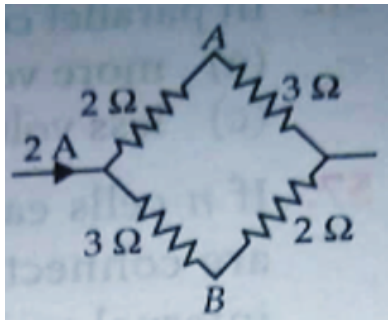
A) only (i)

B) only (iii)

C) only (i) and (iii)

D) (i), (ii) and (iii)

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



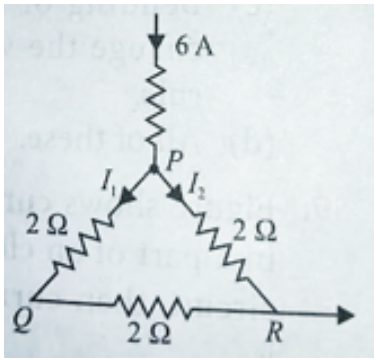
A) 1 V

B) 2 V

C) 3 V

D) 4 V

6. A current of 6 A enters one corner P of an equilateral triangle PQR having 3 wires of resistances 2Ω each and leaves by the corner R. Then the currents I_1 and I_2 are



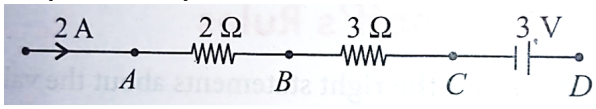
A) 2 A, 4 A

B) 4 A, 2 A

C) 1 A, 2 A

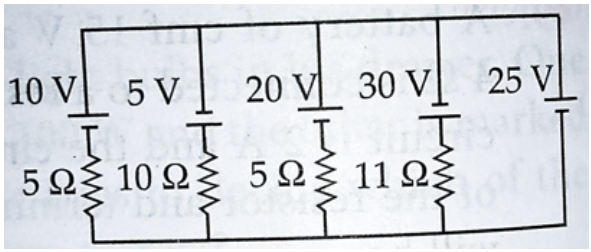
D) 2 A, 3 A

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



A) $V_A = 4V; V_D = 9V$ **B)** $V_A = 3V; V_D = 4V$
C) $V_A = 9V; V_D = 3V$ **D)** $V_A = 4V; V_D = 3V$

8. In the circuit shown, current flowing through 25V cell is



A) 7.2 A **B)** 10 A
C) 11 A **D)** 14.2 A

9. In a wheatstone bridge if the battery and galvanometer are interchanged then the deflection in galvanometer will

A) change in previous direction **B)** not change
C) change in opposite direction **D)** none of these.

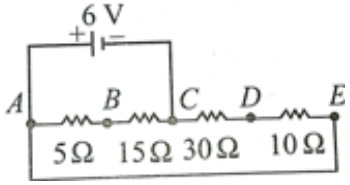
10. In a Wheatstone's network, $P = 2\Omega, Q = 2\Omega, R = 2\Omega$ and $S = 3\Omega$. The resistance with which S is to be shunted in order that the bridge may be balanced is

A) 1 Ω **B)** 2 Ω
C) 4 Ω **D)** 6 Ω

11. 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

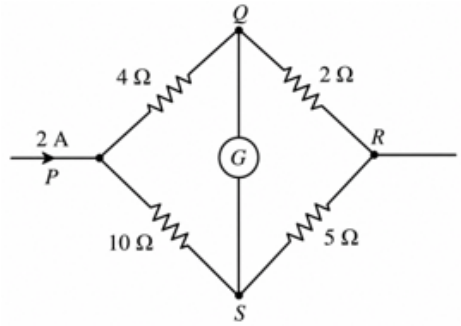
A) 10Ω **B)** 11Ω
C) 12Ω **D)** 13Ω

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



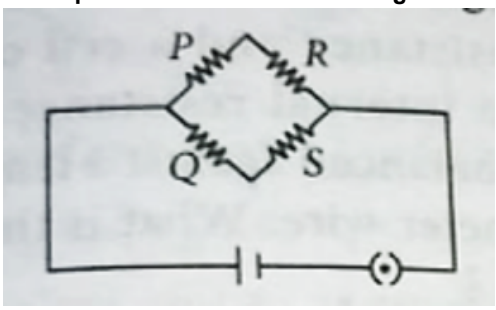
A) Zero **B)** 1.5 V
C) 2 V **D)** 3 V

13. In the shown figure, bridge is balanced, the current flowing through 2Ω resistance is



A) $\frac{10}{7}A$ **B)** $\frac{11}{7}A$
C) $\frac{13}{7}A$ **D)** $\frac{8}{7}A$

14. The equation of a wheatstone bridge is



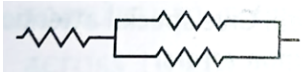
A) $PR = QS$ **B)** $PQ = RS$
C) $PS = QR$ **D)** $P/S = Q/R$

15. Which arrangement of 3Ω resistors will give a total resistance of 7Ω?

A)

B)

C)

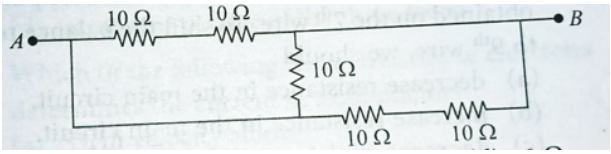


D)

16. Choose the correct combination of three resistances 1Ω, 2Ω and 3Ω to get equivalent resistance $\frac{11}{5}\Omega$.

A) all three are combined in parallel **B)** all three are combined in series
C) 1Ω and 2Ω in parallel and 3Ω is in series to both **D)** 2Ω and 3Ω are combined in parallel and 1Ω is in series to both.

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



A) 10 Ω **B)** 5 Ω
C) 15 Ω **D)** 6 Ω

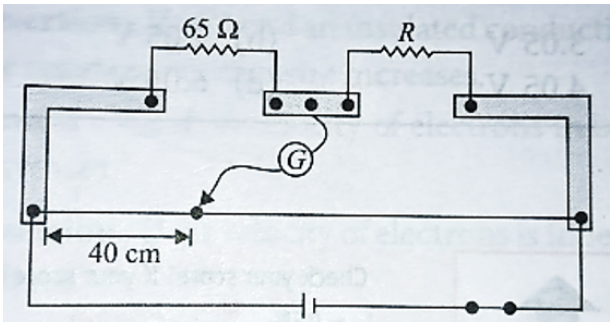
18. Three resistors $2\Omega, 4\Omega$ and 5Ω are combined in parallel. This combination is connected to a battery of emf 20V and negligible internal resistance. The total current drawn from the battery is

A) 10 A **B)** 15 A
C) 19 A **D)** 23 A

19. When a metal conductor connected to the left gap of a meter bridge is heated, the balancing point

A) shifts towards right **B)** shifts towards left
C) remains unchanged **D)** remains at zero

20. What is the value of unknown resistance R, if galvanometer shows null deflection in the given meter bridge set up?



A) 97.50 Ω **B)** 105 Ω
C) 150 Ω **D)** 110 Ω

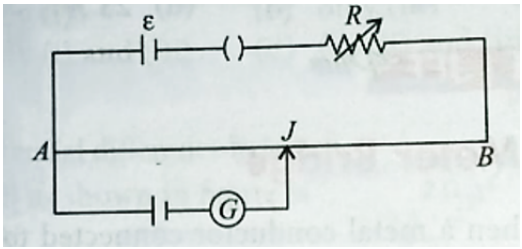
21. In a meter bridge experiment, the ratio of the left gap resistance to right gap resistance is 2 : 3, the balance point from left is

A) $60\ \text{cm}$ **B)** $50\ \text{cm}$
C) $40\ \text{cm}$ **D)** $20\ \text{cm}$

22. A wire connected in the left gap of a meter bridge balance a 10Ω resistance in the right gap to a point, which divides the bridge wire in the ratio 3 : 2. If the length of the wire is $1\ \text{m}$. The length of one ohm wire is

A) $0.057\ \text{m}$ **B)** $0.067\ \text{m}$
C) $0.37\ \text{m}$ **D)** $0.134\ \text{m}$

23. AB is a wire of potentiometer with the increase in the value of resistance R, the shift in the balance point J will be



A) towards B **B)** towards A
C) remains constant **D)** first towards B then back towards A.

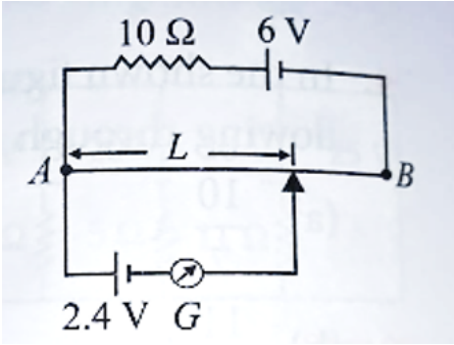
24. In a potentiometer a cell of emf 1.5V gives a balanced point at 32 cm length of the wire. If the cell is replaced by another cell then the balance point shifts to 65.0cm then the emf of second cell is

A) 3.04 V **B)** 2.05 V
C) 4.05 V **D)** 6.05 V

25. In a potentiometer experiment, the balancing length for a cell of e.m.f. 1.5 V is found to be 60 cm. If the cell is replaced by another cell of e.m.f. E', the balancing length is found to be 80 cm. Calculate the value of E'.

A) 2.0 V **B)** 1.5 V
C) 2.5 V **D)** 1.0 V

26. A potentiometer wire of length 200 cm has a resistance of 20Ω. It is connected in series with a resistance of 10Ω and an accumulator of emf 6 V having negligible internal resistance. A source of 2.4 Vis balanced against a length L of the potentiometer wire. The value of L is

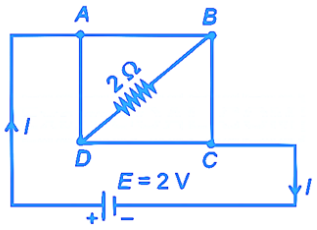


A) 100 cm **B)** 120 cm
C) 110 cm **D)** 140 cm

27. A potentiometer wire of length 100 cm has a resistance of 10Ω. It is connected in series with a resistance and a cell of emf 2 V and of negligible internal resistance. A source of emf 10 mV is balanced against a length of 40 cm of the potentiometer wire. What is the value of external resistance?

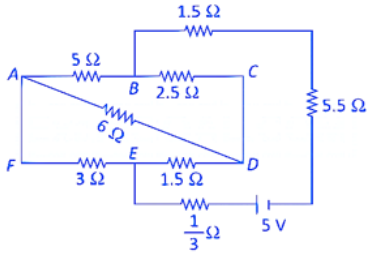
A) 790 Ω **B)** 890 Ω
C) 990 Ω **D)** 1090 Ω

28. A uniform metallic wire having resistance 4Ω is bent to form a square loop (ABCD) (see figure). A resistance of 2Ω is connected between points B and D and a battery of 2 V is connected across points A and C as shown in the figure. Now the value of current (l) is



A) 2 A **B)** 8 A
C) 4.5 A **D)** 4 A

29. The current passing through the battery in the given



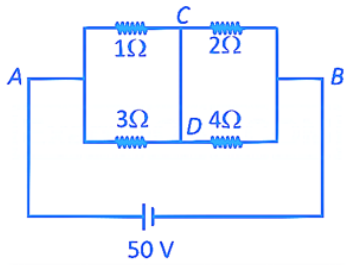
circuit, is:

A) 2.5 A **B)** 1.5 A
C) 2.0 A **D)** 0.5 A

30. A wire of resistance R is cut into 8 equal pieces. From these pieces two equivalent resistances are made by adding four of these together in parallel. Then these two sets are added in series. The net effective resistance of the combination is:

A) $\frac{R}{16}$ **B)** $\frac{R}{8}$
C) $\frac{R}{64}$ **D)** $\frac{R}{32}$

31. A constant voltage of 50 V is maintained between the points A and B of the circuit shown in the figure. The current through the branch C D of the circuit is:

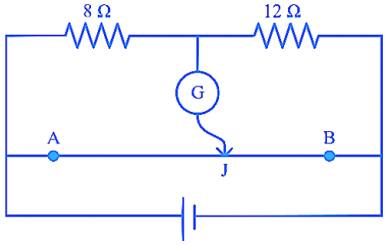


A) 2.5 A **B)** 3.0 A
C) 1.5 A **D)** 2.0 A

32. A uniform metal wire of length l has 10Ω resistance. Now this wire is stretched to a length 2land then bent to form a perfect circle. The equivalent resistance across any arbitrary diameter of that circle is

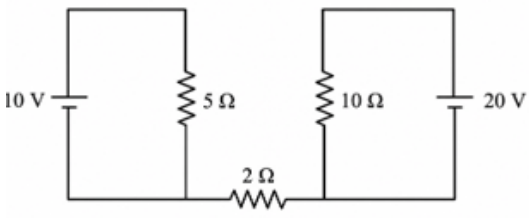
A) 10Ω **B)** 5Ω
C) 40Ω **D)** 20Ω

33. The given circuit shows a uniform straight wire A B of 40 cm length fixed at both ends. In order to get zero reading in the galvanometer G, the free end of J is to be placed from B at:



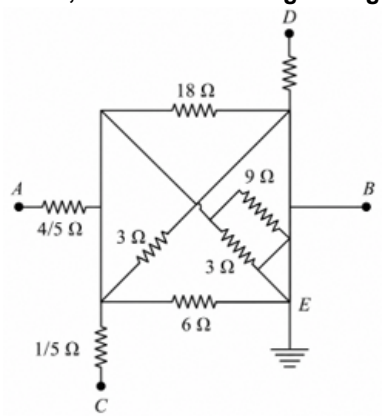
A) 32 cm **B)** 8 cm
C) 16 cm **D)** 24 cm

34. 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

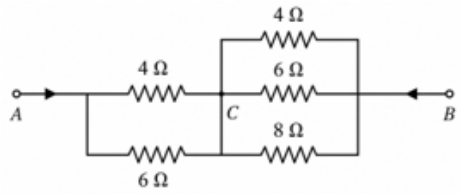
35. if a battery is connected between points A and B, e.m.f $E = 18$ V, the current flowing through the



battery is

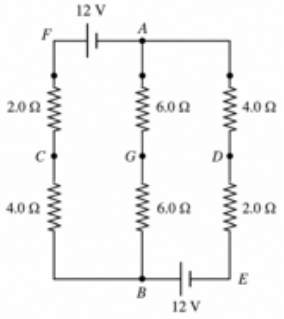
A) 10 A **B)** 20 A
C) 5 A **D)** 15 A

36. 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

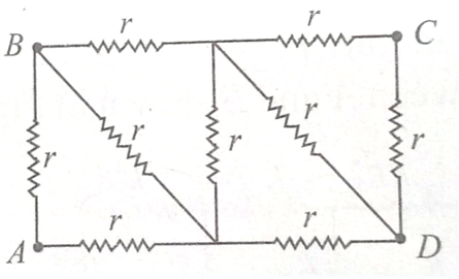
37. In the network the potential difference across A and



B is

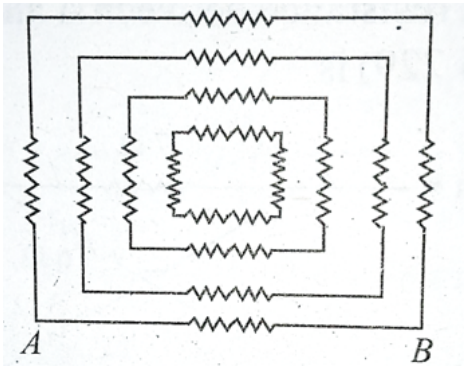
A) 6 V **B)** zero
C) 2 V **D)** 4 V

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



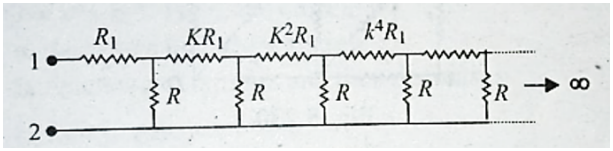
A) $\frac{12}{11}r$ B) $\frac{13}{11}r$
C) $\frac{14}{11}r$ D) $\frac{15}{11}r$

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



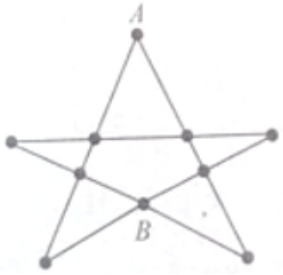
A) Ω B) 2Ω
C) 3Ω D) 4Ω

40. 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.



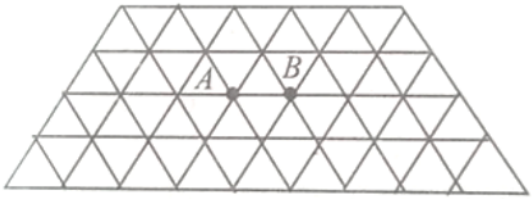
A) $\frac{R_1-R_2}{2}$ B) $\frac{(R_1-R_2)+\sqrt{R_1^2+R_2^2+6R_1R_2}}{2}$
C) $\frac{(R_1-R_2)+\sqrt{6R_1R_2}}{2}$ D) None of these

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



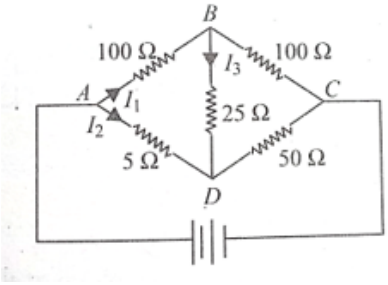
A) $\frac{7}{3}R$ B) $\frac{7}{6}R$
C) $\frac{14}{8}R$ D) None of these

42. 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.



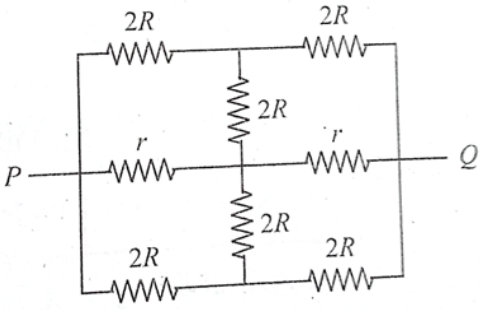
A) R_0 B) $\frac{R_0}{2}$
C) $\frac{R_0}{3}$ D) $\frac{R_0}{4}$

43. 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?



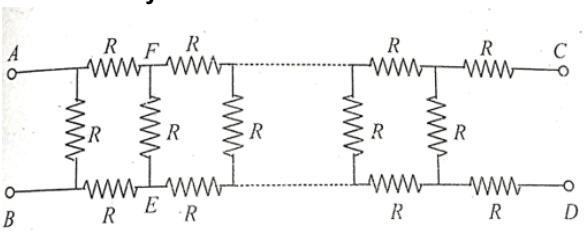
A) I_1, I_2, I_3 B) I_2, I_3, I_1
C) I_2, I_1, I_3 D) I_3, I_2, I_1

44. 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) $\frac{5R}{2} + 2r$

45. 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) $R(\sqrt{3}+1)$

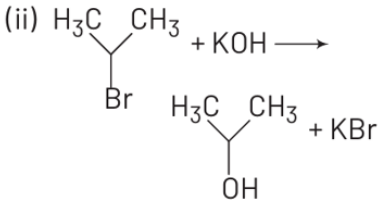
Chemistry

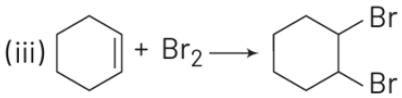
46. Elimination reaction of 2-bromo-pentane to form pent-2-ene is: 1. β-elimination reaction. 2. Follows Zaitsev rule. 3. Dehydrohalogenation reaction. 4. Dehydration reaction.

A) (1), (3), (4) **B)** (2), (3), (4)
C) (1), (2), (4) **D)** (1), (2), (3)

47. For the following reactions

(i) $CH_3CH_2CH_2Br + KOH \rightarrow CH_3CH{=}CH_2 + KBr + H_2O$

(ii) 

(iii) 

Which of the following statements is correct?

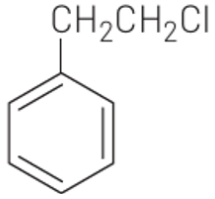
A) (i) is elimination reaction, (ii) is substitution and (iii) is addition reaction
B) (i) is elimination, (ii) and (iii) are substitution reactions
C) (i) is substitution, (ii) and (iii) are addition reactions
D) (i) and (ii) are elimination reactions and (iii) is addition reaction

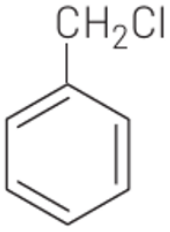
48. 2-bromopentane is heated with potassium ethoxide in ethanol. The major product obtained is:

A) 2-ethoxypentane **B)** pentene-1
C) trans-pentene-2 **D)** D)cis-pentene-2

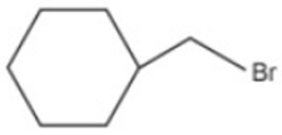
49. Which of the following will not undergo S_N1 reaction with OH^-?

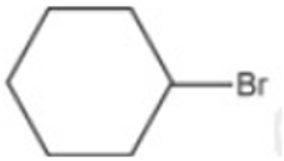
A) $CH_2 = CH - CH_2Cl$ **B)** $(CH_3)_3CCl$

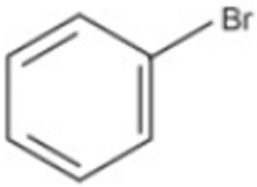
C) 

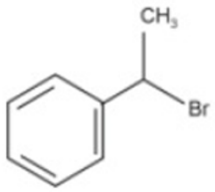
D) 

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

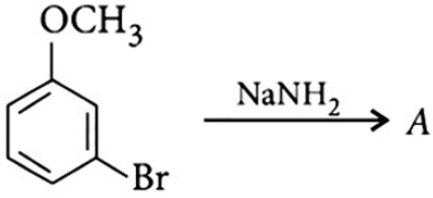
A) 

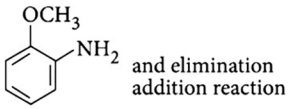
B) 

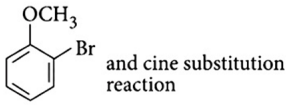
C) 

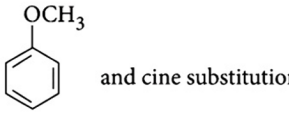
D) 

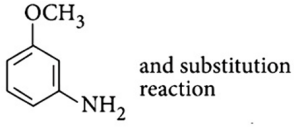
51. Identify A and predict the type of reaction.



A) 

B) 

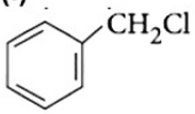
C) 

D) 

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

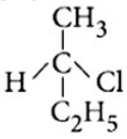
A) ethanol **B)** methanol
C) N,N'-dimethylformamide (DMF) **D)** water

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

(i) 

(ii) $CH_3CH_2CH_2Cl$

(iii) $H_3C - \overset{CH_3}{\underset{|}{C}}H - CH_2Cl$

(iv) 

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

54. The mechanisms of reactions (i)

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

and (ii)

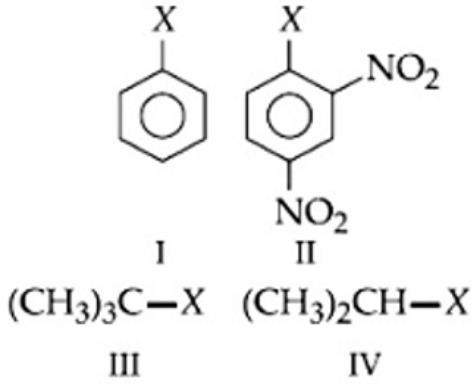
$(CH_3)_2CH - CH_2Br \xrightarrow{C_2H_5O^-} (CH_3)_2CH - CH_2OC_2H_5 + Br^-$

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

55. The correct order of increasing reactivity of



$C - X$ 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

56. Reaction of t-butyl bromide with sodium methoxide produces:

A) sodium t-butoxide **B)** t-butyl methyl ether

C) isobutane **D)** isobutylene

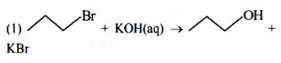
57. Assertion A : Hydrolysis of an alkyl chloride is a slow reaction but in the presence of NaI, the rate of the hydrolysis increases. Reason R : I^- is a good nucleophile as well as a good leaving group. In the light of the above statements, choose the correct answer from the options given below.

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

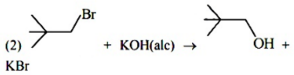
C) Both A and R are true and R is the correct explanation of A **D)** Both A and R are true but R is NOT the correct explanation of A

58. Identify the incorrect option from the following:

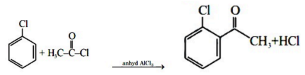
A)



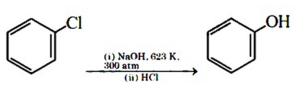
B)



C)

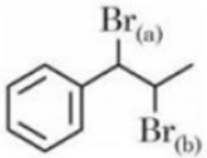


D)

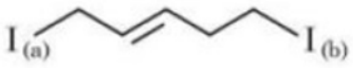


59. Choose the halogen which is most reactive towards S_N1 reaction in the given compounds (A, B, C, & D).

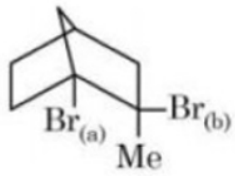
A.



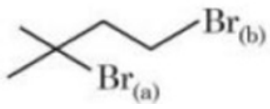
B.



C.



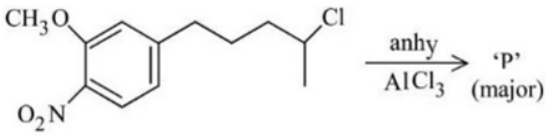
D.



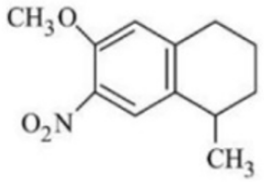
A) A— $Br_{(a)}$; B— $I_{(a)}$; C— $Br_{(b)}$; D— $Br_{(a)}$ **B)** A— $Br_{(b)}$; B— $I_{(a)}$; C— $Br_{(a)}$; D— $Br_{(a)}$

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

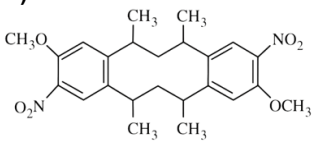
60. The major product 'P' formed in the given reaction is:



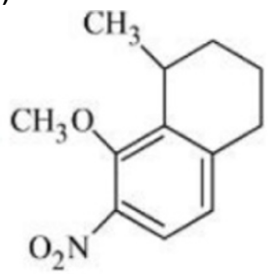
A)



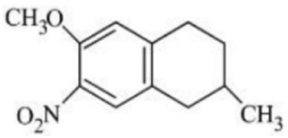
B)



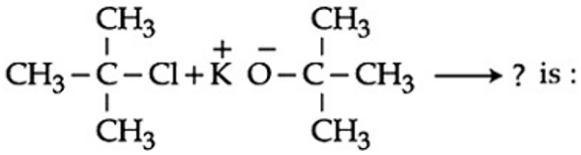
C)



D)



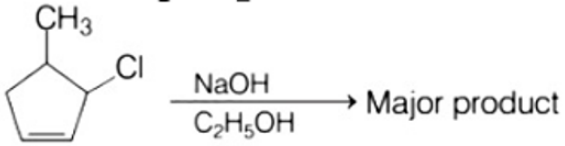
61. The major product in the reaction:



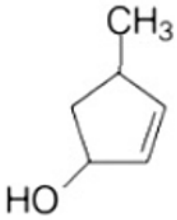
A) t-Butyl ethyl ether **B)** 2,2-Dimethyl butane

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

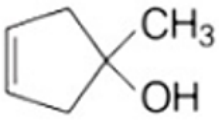
62. The major product of the following reaction is:



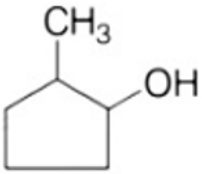
A)



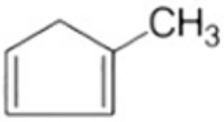
B)



C)

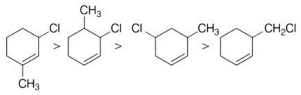


D)

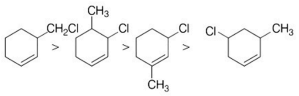


63. The correct order of reactivity of the given chlorides with acetate in acetic acid is:

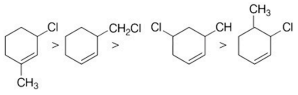
A)



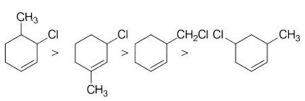
B)



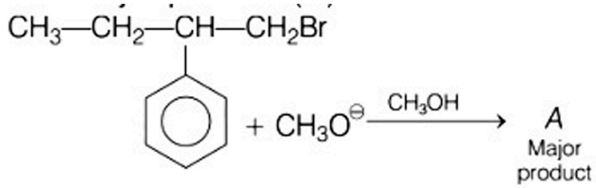
C)



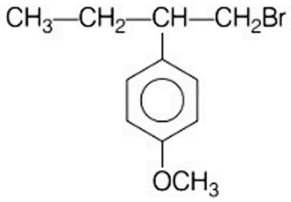
D)



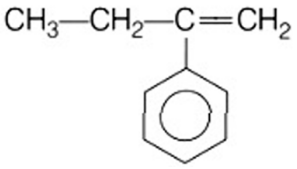
64. The major product (A) formed in the reaction given below is:



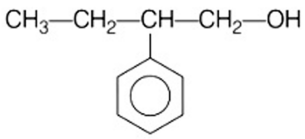
A)



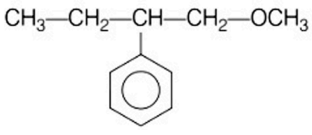
B)



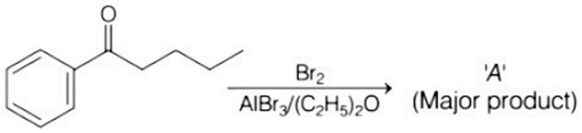
C)



D)

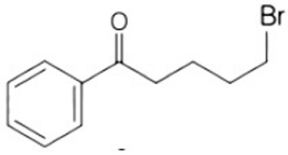


65.

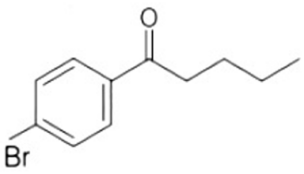


Consider the given reaction, the product A is: (Reaction: Valerophenone + Br_2 in $AlBr_3/(C_2H_5)_2O$)

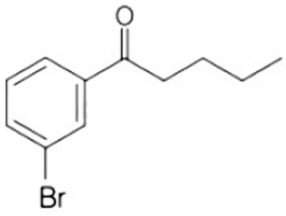
A)



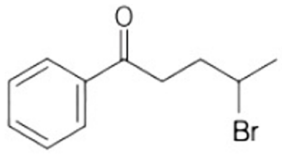
B)



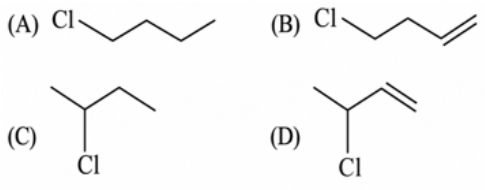
C)



D)



66. The decreasing order of reactivity towards dehydrohalogenation (E_1) reaction of the following compounds is:



A) D > B > C > A
B) B > D > A > C
C) B > D > C > A
D) B > A > D > C

67. Consider the following reactions: (1)

$(CH_3)_3CCH(OH)CH_3 \xrightarrow{conc.H_2SO_4}$ **(2)**

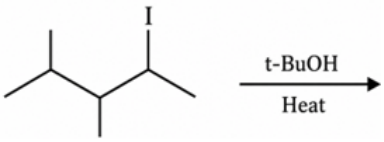
$(CH_3)_2CHCH(Br)CH_3 \xrightarrow{alc.KOH}$ **(3)**

$(CH_3)_2CHCH(Br)CH_3 \xrightarrow{(CH_3)_3O^-K^+}$ **(4)**

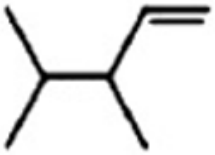
$(CH_3)_3CCH(OH)CH_3 \xrightarrow{\text{conc. } H_2SO_4}$ **Which of these reaction(s) will not produce Saytzeff product?**

A) (1), (3) and (4)
B) (4) only
C) (3) only
D) (2) and (4)

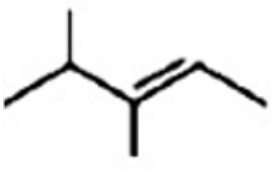
68. The major product in the following reaction is:



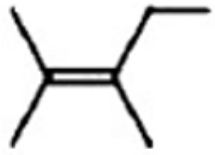
A)



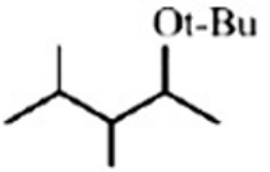
B)



C)

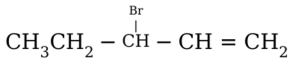


D)

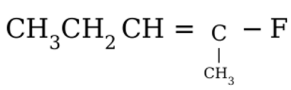


69. The major product obtained from E2-elimination of 3-bromo-2-fluoropentane is:

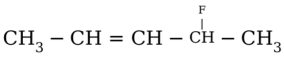
A)



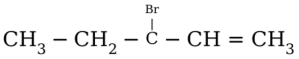
B)



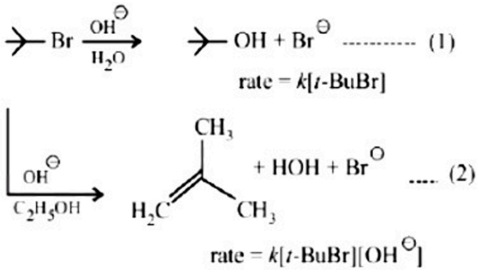
C)



D)



70. Consider the reaction sequence given below:



Which of the following statements is true?

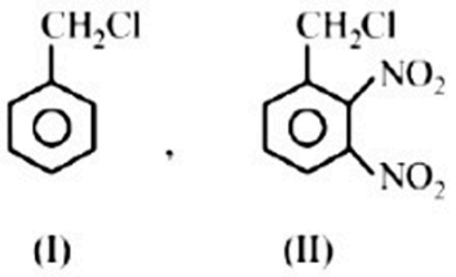
A) Changing the base from OH^- to ^-OR will have no effect on reaction (2).

B) Changing the concentration of base will have no effect on reaction (1).

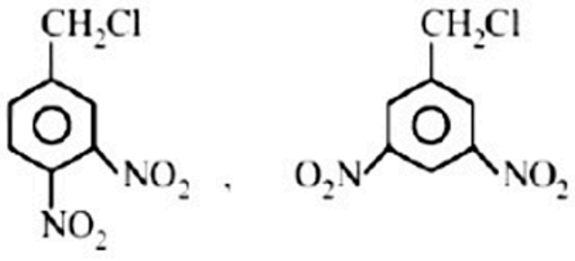
C) Doubling the concentration of base will double the rate of both the reactions.

D) Changing the concentration of base will have no effect on reaction (2).

71. The decreasing order of reactivity of the following compounds towards nucleophilic substitution (S_N2) is:



(I) (II)



(III) (IV)

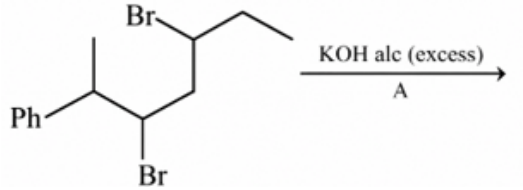
A) (II) > (III) > (I) > (IV)

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

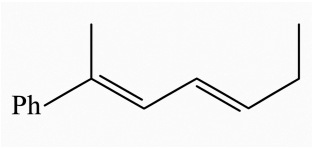
C) (III) > (II) > (I) > (IV)

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

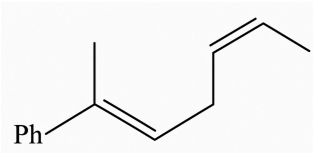
72. The major product of the following reaction is:



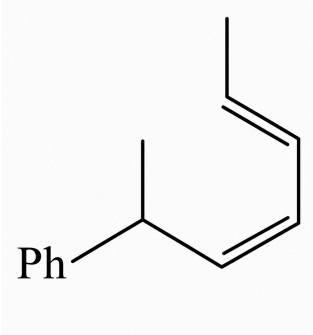
A)



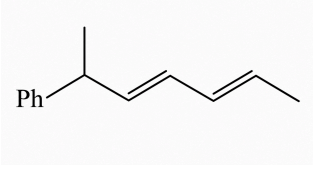
B)



C)



D)



73. Which hydrogen in compound (E) is easily replaceable during bromination reaction in presence of light? $CH_3(\delta) - CH_2(\gamma) - CH(\beta) = CH_2(\alpha)$

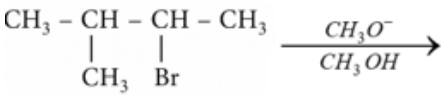
A) α - hydrogen

B) γ - hydrogen

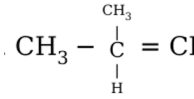
C) δ - hydrogen

D) β - hydrogen

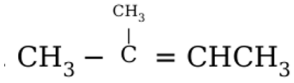
74. The major product of the following reaction is:



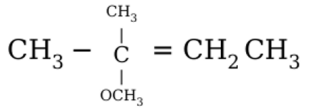
A)



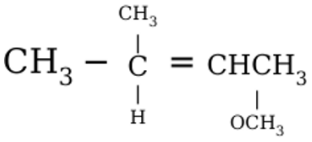
B)



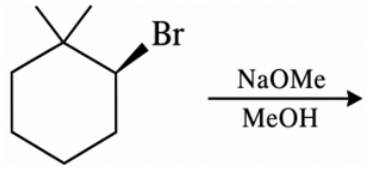
C)



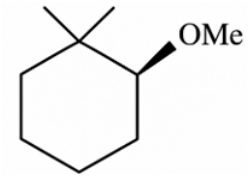
D)



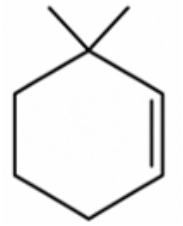
75. The major product of the following reaction is:



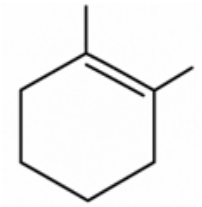
A)



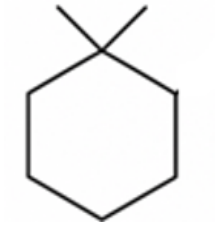
B)



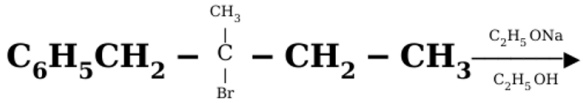
C)



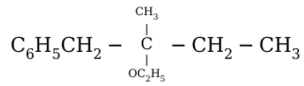
D)



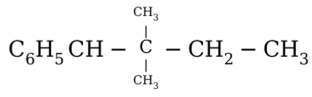
76. The major product of the following reaction is:



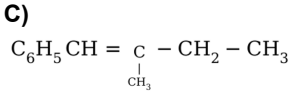
A)



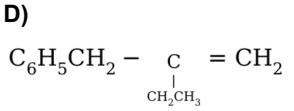
B)



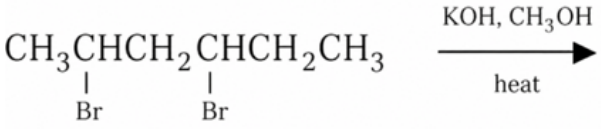
C)



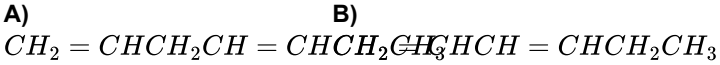
D)



77. The major product of the following reaction is:



A)

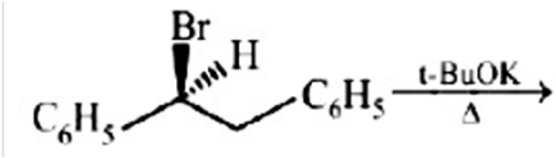


B)

C)

D)

78. The major product obtained in the following reaction is:



A)

B) $C_6H_5CH = CHC_6H_5$

C)

D)

79. Elimination of bromine from 2 -bromobutane results in the formation of

A) Predominantly 2 -butyne
B) Predominantly 1-butene
C) Predominantly 2 -butene
D) Equimolar mixture of 1 and 2 -butene

80. Reaction of trans2-phenyl-1-bromocyclopentane on reaction with alcoholicKOHproduces:

A) 1-phenylcyclopentene
B) 3-phenylcyclopentene
C) 2-phenylcyclopentene
D) 4-phenylcyclopentene

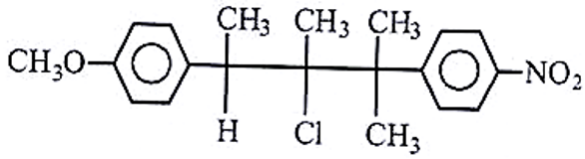
81. 1-Chlorobutane on reaction with alcoholic potash gives:

A) 1-butene
B) 1-butanol
C) 2-butene
D) 2-butanol

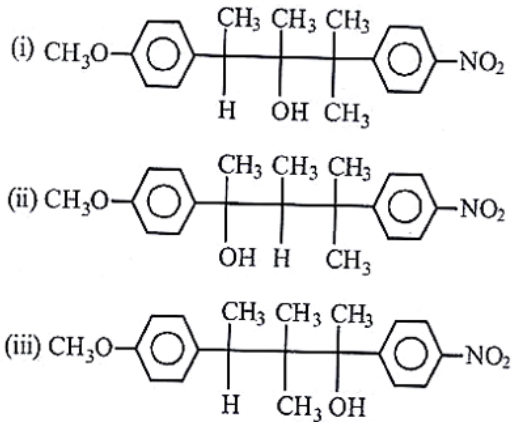
82. n-Propyl bromide on treatment with ethanolic potassium hydroxide produces:

A) Propane
B) Propene
C) Propyne
D) Propanol

83.



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)

84. An S_N2 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

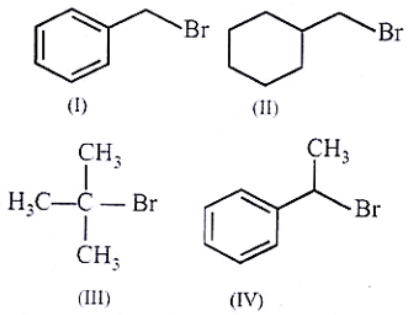
85. Which of the following has the highest nucleophilicity?

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

86. The total number of alkenes possible by dehydrobromination of 3-bromo-3-cyclopentylhexane using alcoholic KOHis:

A) 3
B) 4
C) 5
D) 6

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



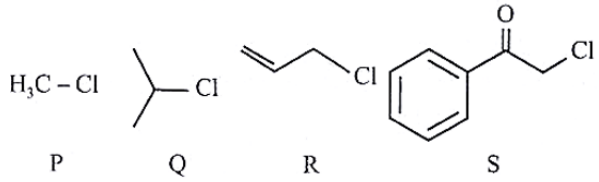
A) I and III follow S_N1 mechanism B) I and II follow S_N2 mechanism C) Compound IV undergoes inversion of configuration D) All are correct

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

88. The order of reactivity of the following alkyl halides for an S_N2 reaction is:

A) $RF > RCl > RBr > RI$
B) $RF > RBr > RCl > RI$
C) $RCl > RBr > RF > RI$
D) $RI > RBr > RCl > RF$

89. 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) $R > P > S > Q$

90. 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

Botany

91. A true-breeding plant line is one that

A) shows a stable trait inheritance and expression for several generations
B) has undergone continuous cross-pollination
C) is heterozygous for all traits.
D) displays a 3:1 phenotypic ratio in the first generation.

92. Phenotypic and genotypic ratios are exactly identical (1:2:1) in the generation of which cross?

A) Test cross
B) Incomplete dominance
C) complete dominance
D) Both a and b

93. In a test cross, an organism showing a dominant phenotype is crossed with an organism that is

A) homozygous dominant for the trait.
B) heterozygous dominant for the trait.
C) homozygous recessive for the trait.
D) heterozygous recessive for the trait.

94. Alleles are described as

A) alternate forms of a gene.
B) homologous chromosomes.
C) linked genes on the same chromosome.
D) non-functional segments of DNA.

95. The physical or visual expression of an individual's genetic makeup is known as the

A) Genotype
B) Holotype
C) Phenotype
D) Ideotype

96. When both alleles of a pair are fully expressed in a heterozygote, the condition is called

A) Incomplete dominance
B) Epistasis
C) Polygenic inheritance
D) Codominance

97. The term "Hemizygous" is most appropriately used to describe genes present on

A) Autosomes in females
B) The X-chromosome in males
C) Homologous regions of chromosomes
D) Polytene chromosomes

98. The physical position or specific location of a gene on a chromosome is called its

A) Locus **B)** Allele
C) Genome **D)** Cistron

99. The term "Genetics" was proposed by which of the following scientists?

A) Johannsen **B)** Morgan
C) Mendel **D)** Bateson

100.
Read the given statements and select the correct option. Statement 1: The law of segregation is one of the most important contributions to biology. Statement 2: Law of segregation introduced the concept of heredity factors as discrete physical entities which do not become blended.

A) Both statements 1 and 2 are correct. **B)** Statement 1 is correct but statement 2 is incorrect.
C) Statement 1 is incorrect but statement 2 is correct. **D)** Both statements are incorrect.

101.
How many true-breeding pea plant varieties did Mendel select as pairs, which were similar except for one character with contrasting traits?

A) 7 **B)** 14
C) 4 **D)** 2

102.
Mendel did not include which of the following concepts in his laws?

A) Segregation **B)** Dominance
C) Purity of gametes **D)** Linkage

103.
To determine whether a tall pea plant from the F2 generation is homozygous (TT) or heterozygous (Tt), it should be crossed with:

A) A true-breeding tall plant (TT) **B)** A heterozygous tall plant (Tt)
C) A dwarf plant (tt) **D)** Any F1 hybrid plant

104.
In Snapdragons (Antirrhinum majus), a cross between a true-breeding red-flowered plant (RR) and a true-breeding white-flowered plant (rr) results in pink-flowered F1 plants (Rr). When these F1 plants are self-pollinated, the F2 generation shows a phenotypic ratio of 1 Red : 2 Pink : 1 White. This is an example of:

A) Co-dominance **B)** Complete dominance
C) Incomplete dominance **D)** Epistasis

105.
According to the explanation of the concept of dominance, a wild-type, unmodified allele typically produces:

A) A non-functional enzyme **B)** No enzyme at all
C) The normal, original enzyme **D)** A mutated substrate

106.
Which of Mendel's laws could not be confirmed by a monohybrid cross alone and explicitly required a dihybrid cross?

A) Law of Dominance **B)** Law of Segregation
C) Law of Purity of Gametes **D)** Law of Independent Assortment

107.
ABO blood grouping in humans is a classic example of:

A) Incomplete dominance only **B)** Co-dominance and Multiple allelism
C) Pleiotropy and Dominance **D)** Polygenic inheritance

108.
Mendel's work remained unrecognized from 1865 until 1900. Which of the following was NOT a reason for this delay?

A) His aggressive use of heavy mathematical models was widely disliked by biologists. **B)** Communication was difficult, preventing his work from being widely publicized.
C) His concept of stable, discrete "factors" was rejected by contemporaries who observed continuous variation in nature. **D)** He could not provide physical proof for the existence of factors (genes).

109.
In a plant species, yellow seed colour (Y) is dominant over green (y). If a yellow-seeded plant of unknown genotype is crossed with a green-seeded plant and yields 53 yellow and 49 green offspring, the genotype of the unknown parent is:

A) YY **B)** Yy
C) yy **D)** Cannot be determined

110.
Identify the incorrect statement regarding Mendel's experiments:

A) He used statistical analysis and mathematical logic. **B)** His experiments had a small sampling size, which reduced credibility.
C) He conducted artificial pollination experiments using true-breeding lines. **D)** Confirmation of his inferences on successive generations proved his laws.

111.
Given below are two statements: Statement I: The Law of Dominance explains why only one parental character is expressed in the F1 generation of a monohybrid cross. Statement II: The Law of Dominance explains the expression of both parental characters in a 3:1 ratio in the F2 generation.

A) Statement I is correct but Statement II is incorrect.
B) Statement I is incorrect but Statement II is correct.
C) Both Statement I and Statement II are correct.
D) Both Statement I and Statement II are incorrect.

112.
In 1900 A.D., three biologists independently rediscovered Mendel's principles of inheritance. They are:

A) Sutton, Morgan, and Bridges
B) Avery, MacLeod, and McCarty
C) De Vries, Correns, and Tschermak
D) Bateson, Punnett, and Bridges

113.
Which of the following is NOT one of the seven characters studied by Mendel in the garden pea plant?

A) Pod length
B) Flower position
C) Stem height
D) Seed shape

114.
What is the probability of production of dwarf offspring in a cross between two heterozygous tall pea plants?

A) Zero
B) 50%
C) 25%
D) 100%

115.
Assertion (A): The Law of Dominance does not apply universally to all traits in all organisms. Reason (R): Phenomena like incomplete dominance and codominance show intermediate and simultaneous phenotypic expressions respectively.

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

116.
Statement I: In a monohybrid cross, the F1 generation always resembles one of the parents if the trait follows the Law of Dominance. Statement II: The phenotypic and genotypic ratios are identical in the F2 generation of a cross that strictly follows the Law of Dominance.

A) Both Statement I and Statement II are correct.
B) Statement I is correct but Statement II is incorrect.
C) Statement I is incorrect but Statement II is correct.
D) Both Statement I and Statement II are incorrect.

117.
Incomplete dominance occurs when...

A) Chromosomes are deleted.
B) Heterozygotes synthesize a reduced amount of an enzyme, producing an intermediate phenotype.
C) The genes fail to segregate.
D) The law of independent assortment is upheld.

118.
A cross between a black cat and a tan cat produces tabby (striped) kittens. If a tabby cat is crossed with a tan cat, what is the probability of getting a black kitten?

A) 0%
B) 25%
C) 50%
D) 75%

119.
A man with blood group A marries a woman with blood group B. They have a child with blood group O. What are the genotypes of the parents?

A) I^AI^A and I^BI^O
B) I^AI^O and I^BI^B
C) I^AI^O and I^BI^O
D) I^AI^A and I^BI^B

120.
How many different genotypes and phenotypes are possible in the human ABO blood grouping system, which is controlled by three alleles (I^A, I^B, I^O)?

A) 3 Genotypes, 4 Phenotypes
B) 4 Genotypes, 6 Phenotypes
C) 6 Genotypes, 4 Phenotypes
D) 6 Genotypes, 6 Phenotypes

121.
According to Mendel's Law of Dominance, discrete units that control characters are called:

A) Alleles
B) Factors
C) Genes
D) Chromosomes

122.
Mendel used the Law of Dominance to explain the expression of:

A) Only one of the parental traits in the F1 generation and both in the F2 generation.
B) Only one of the parental traits in the F1 generation and the 3:1 proportion in the F2 generation.
C) Both parental traits simultaneously in the F1 generation.
D) A completely new blended intermediate trait in the F1 generation.

123.
In garden peas, smooth seed shape (S) is dominant over wrinkled seed shape (s). A plant heterozygous for seed shape is self-pollinated. Out of 400 seeds collected from this cross, approximately how many seeds are expected to be wrinkled?

A) 300
B) 200
C) 100
D) 0

124.
Which of the following crosses would best validate whether a specific trait follows Mendel's Law of Dominance or represents a case of Incomplete Dominance?

A) True-breeding dominant × True-breeding dominant
B) True-breeding dominant × True-breeding recessive
C) Heterozygous dominant × Homozygous recessive
D) Heterozygous dominant × Heterozygous dominant

125.
Read the following statements regarding the Law of Dominance: 1. It explains why the recessive trait is completely lost in the population. 2. It relies on the fact that factors occur in pairs in diploid organisms. 3. In a dissimilar pair of factors, the recessive factor is modified and functional. Which of the statements given above is/are CORRECT?

A) 1 and 2 only
B) 2 only
C) 2 and 3 only
D) 1, 2, and 3

126.
The Law of Segregation is based on the fact that alleles do not show any blending and that:

A) Only one character is recovered in the F2 generation.
B) Both characters are recovered as such in the F2 generation, though one is not seen at the F1 stage.
C) Both characters are lost completely during gametogenesis.
D) The dominant character modifies the recessive allele structurally.

127.
Why is the Law of Segregation also universally known as the "Law of Purity of Gametes"?

A) Gametes contain both alleles but express only one.
B) Gametes are completely free from any environmental mutations.
C) A gamete receives only one of the two alleles and is never hybrid.
D) Gametes only carry dominant alleles.

128.
According to Mendelian principles, which law of inheritance is considered universal with absolutely no known exceptions in sexually reproducing diploid organisms?

A) Law of Dominance
B) Law of Segregation
C) Law of Independent Assortment
D) Law of Codominance

129.
A person with AB blood group marries a person with O blood group. What are the possible blood groups of their offspring?

A) Only AB
B) Only A and B
C) A, B, and O
D) A, B, AB, and O

130.
In Andalusian fowls, a cross between a pure black fowl (BB) and a pure white fowl (bb) produces blue fowls (Bb). If a poultry farmer crosses two blue fowls, what percentage of the offspring is expected to be blue?

A) 25%
B) 50%
C) 75%
D) 100%

131.
The graphical representation used to calculate the probability of all possible genotypes of offspring in a genetic cross is called a:

A) Punnett square
B) Pedigree chart
C) Idiogram
D) Karyogram

132.
Mendel's work on the inheritance of one gene did not yield any blending of traits in either the F1 or F2 generations. This observation provided direct proof for which biological principle?

A) Law of Independent Assortment
B) Law of Segregation
C) Concept of Co-dominance
D) Chromosomal Theory of Inheritance

133.
To determine whether a tall pea plant from the F2 generation is homozygous (TT) or heterozygous (Tt), which cross must be performed?

A) Back cross with the dominant parent (TT)
B) Reciprocal cross
C) Test cross with a dwarf plant (tt)
D) Self-pollination

134.
For how many years did Gregor Mendel conduct his hybridization experiments on garden peas, and during which specific period?

A) 5 years (1850 – 1855)
B) 7 years (1856 – 1863)
C) 7 years (1865 – 1872)
D) 10 years (1857 – 1867)

135.
Which of the following traits studied by Mendel in the garden pea represents a recessive character?

A) Axial flower position
B) Green pod colour
C) Yellow seed colour
D) Terminal flower position

Zoology

136.

Myofibril of skeletal muscle fibre has two contractile filaments. Which of the following is matching with respect to type of protein, its presence and characteristic?

A) Tropomyosin-Protein, Thin filament-Found in, Masking and unmasking active sites-Characteristic

B) Troponin-Protein, Thick filament-Found in, Binding with $Ca^{2+}$and tropomyosin-Characteristic

C) Actin-Protein, Thin filament-Found in, Having ATP pockets for ATPase activity-Characteristic

D) Meromyosin-Protein, Thick filament-Found in, Having active sites to bind with thin filaments-Characteristic

137.

During muscle contraction

A) Myofilaments shorten, I bands retain their length.

B) Myofilaments not shorten, A bands shorten

C) A bands retain their size/ length, I bands get reduced in size/ length, H bands become narrow

D) Myofilaments do not actually shorten, A bands shorten, H bands become broad

138.

Choose the correct statement about muscles.

A) Muscles are the specialized tissues of mesodermal origin

B) About 40-50% of the body weight is contributed by muscles

C) Muscles have special properties like excitability, contractibility and extensibility

D) All of the above

139.

Based on their location in humans body or animals types of muscles are I) skeletal II) visceral III) cardiac IV) voluntary V) striated VI. Smooth The correct option is

A) I , II and IV

B) III and VI

C) I, II and V

D) I, II and III

140.

Skeletal muscles are closely associated with the …..A…. components of the body. They have …B… appearance under the microscope and hence are called …C… muscles. Choose the correct options to fill A, B and C.

A) A-muscular, B-stripped, C-striated

B) A-visceral, B-stripped, C-striated

C) A-skeletal, B-striped, C-striated

D) A-micro fibrillar, B-stripped, C-striated

141.

Identify the muscle which represents the following characteristics and choose the correct option accordingly. I) Transportation of food through the digestive tract. II) Transportation of gametes through the genital tract.

A) Skeletal muscles

B) Visceral muscles

C) Cardiac muscles

D) Striated muscles

142.

A… band contains actin and is called …B… band, whereas the …C… band called ..D… band contains myosin. Choose the correct options for A, B and C to complete the given NCERT statement.

A) A-Light, B-I, C-dark, D-A

B) A-Dark, B-I, C-light, D-A

C) A-Dark, B-A, C-light, D-I

D) A-Light, B-A, C-dark, D-I

143.

Sarcomere is a

A) functional unit of contraction

B) portion of myofibril present in between two M-lines

C) complete bundle of muscles

D) portion of myofibril present in between two A-bands

144.

In a __A___state, the edges of thin filaments on either side of the thick filaments ____B___ overlap the free ends of the thick filaments leaving the central part of the thick filaments. This central part of __C___ filament, not overlapped by thin filaments is called the ___D___zone. Choose the correct options to fill the gaps A, B, C and D, so as to complete the given NCERT statement.

A) A-resting, B-partially, C-thin, D-H

B) A-resting, B-completely , C-thick, D-A

C) A-resting, B-completely , C-thick, D-I

D) A-resting, B-partially, C-thick, D-H

145.

Cross arms of the myosin monomer consists of

A) outward projection of G-actin filament

B) outward projection of the head region of meromyosin

C) outward projection of the tail region of meromyosin

D) Both (B) and (C)

146.

Arrange the given steps of muscle contraction in the series of events from first to last. I) Myosin head binds to the exposed active site on actin to form a cross bridge. II) The Z-line attached to these actin are also pulled in wards there by causing shortening of sarcomere also called contraction. III) This pulls the attached actin filaments towards the centre of A-band The correct option is

A) I → II → III

B) III → II → I

C) I → III → II

D) III → I → II

147.
The …A… releasing the ADP and Pi goes back to its …B… state. A new ATP binds and the cross bridge is …C… The ATP is again hydrolyzed by the …D… head and cycle of cross bridge formation and breakage is repeated causing further sliding. Fill the appropriate options in the blanks A, B, C and D to complete the given statement

A) A-myosin, B-relaxed, C-broken, D-myosin
B) A-actin, B-relaxed, C-broken, D-myosin
C) A-myosin, B-relaxed, C-broken, D-actin
D) A-actin, B-relaxed, C-broken, D-actin

148.
Only ....A .... muscle are mostly attached to bones and take part in moving them hence they are also called ...B.. muscles Fillin the blanks A and B

A) A – Striated ; B – skeletal
B) A – nonstriated ; B – skeletal
C) A – non striated ; B – cardiac
D) A – striated : B – cardiac

149.
Arrange the following steps of muscle contraction in the sequence of events occurring first. I) Transverse tubule II) Nerve impulse III) Release of Ca^{2+} IV) Acetylcholine release V) Shortening of sarcomere VI) neuro muscular junction VII) cisternae of sarcoplasmic reticulum activated The correct option is

A) II → IV → VI → I → VII → III → V
B) II → IV → I → VI → VII → III → V
C) II → IV → I → VI → VII → V → III
D) IV → II → I → VI → VII → V → III

150.
I) Sarcoplasmic reticulum are abundant. II) Myoglobin content is high. III) Sacroplasmic reticulum are moderate. IV) Aerobic muscles. V) Depends on anerobic respiration for energy. VI) Less myoglobin content. Select the option with correct statements for red muscle.

A) I, II and IV
B) I, II and III
C) II, III and IV
D) II and IV

151.
Select the correct statements. I) During muscle contraction, chemical energy changes into mechanical energy. II) Muscle fatigue occurs due to lactic acid formation. III) The reaction time is different to different muscle. IV) Muscle contraction don't need ATP.

A) All except I
B) All except II
C) All except IV
D) All except I, II

152.
Select the correct statement with reference to muscle structure. I) Each myosin is a polymerized protein. II) Many meromyosin constitutes one thick filament (myosin). III) Each meromyosin's tail is called heavy meromyosin (HMM) and head is called light meromyosin (LMM) IV) The globular head is an active ATPase enzyme and has binding sites for ATP and active sites for actin. Choose the option with correct statements.

A) All except I and II
B) All except III and IV
C) All except III
D) All except I and IV

153.
Ca^{2+} bind …A… in skeletal muscles and leads to the exposure of binding site for …B… on the filament …C… Identify A, B and C, so as to complete the given statements.

A) A-troponin, B-actin, C-relaxin
B) A-actin, B-myosin, C-troponin
C) A-troponin, B-myosin, C-actin
D) A-tropomyosin, B-myosin, C-actin

154.
Regulatory proteins of light band of myofibril

A) Actin and tropomyosin
B) Troponin and tropomyosin
C) Troponin and myosin
D) Tropomyosin and myosin

155.
Choose the incorrect statement among these A. During muscle contraction length of A –band decreases - B. During muscle contraction length of I – bands decreases - C. During muscle contraction length of thin filaments decreases - D. During muscle contraction length of thick filaments decreases - E. During muscle contraction length of thin filaments increases - F. Active sites of actin are covered by tropomyosin in resting state

A) A,B, C, D
B) A, C, D , E
C) A,C,D,E,F
D) A,B,C, D, E ,F

156.
Read the following I. Thicker most part of sarcomere (A)- II.Thinner most part of sarcomere (B) - III. Part of A- band without thin filaments (C) - IV. Zone of A band which is relatively less dark than the edges of A – band (D) – The A B C D are

A) A- band except H- zone; I -band : H- zone : H - zone
B) A – band ; I – band : H – zone : H- zone
C) I – band : I – band : H –z one ; H-zone
D) A – band except H zone : A – band : H zone ; I band

157.
The polypeptide unit of troponin which binds with tropomyosin

A) Tn T
B) Tn I
C) Tn C
D) Tn A

158.
Muscles which are primarily involved in locomotor actions and bringing in changes in body postures are

A) Smooth, skeletal muscles
B) Skletal , striated muscles
C) Striated involuntary muscles
D) Smooth voluntary muscles

159.
Cross bridge means

A) Actomyosin complex
B) Troponin – tropomyosin complex
C) Troponin and actin complex
D) Actin – troponin complex

160.
During relaxation of muscle , when motor impulses stopped

A) calcium ions are back to cisternae
B) active sites are actin are covered by troponin and tropomyosin complex
C) Myosin head Is with ATP
D) All the above

161.
Arrange these in sequence with respect to skeletal muscle contraction - A . Utilization of stored ATP B. Anaerobic respiration C. Taking phosphate from muscle phospagen D . oxygen debt E . Breakdown of glucose by oxygen F. Pyruvic acid formation G. Lactic acid formation

A) ABCDEFG
B) ACEDBFG
C) ACDEFGB
D) ABCEFGD

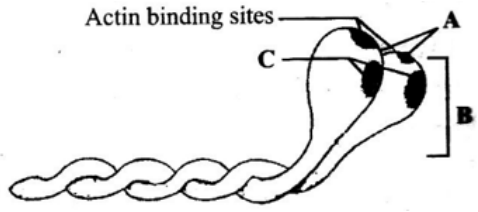
162.
The lactic acid produced during rapid contractions of skeletal muscles under low availability of oxygen is partly oxidized and major part of it is carried ' to ' and 'by' -

A) Kidney and blood
B) Liver and blood
C) Kidney and liver
D) Liver and Lymph

163.
Choose the correct statement among these A. "The heads on the two ends of the thick filaments are oriented in opposite directions to pull in actin filaments of both the sites towards the M- line - B. contraction of a muscle fibre takes place by the sliding of the thin filaments over the thick filaments. C. A motor neuron alongwith the muscle fibres connected to it constitute a motor unit. D. the myosin head binds to the exposed active sites on actin to form a cross arm E. Muscle contraction means pulling thin filaments towards M –line -

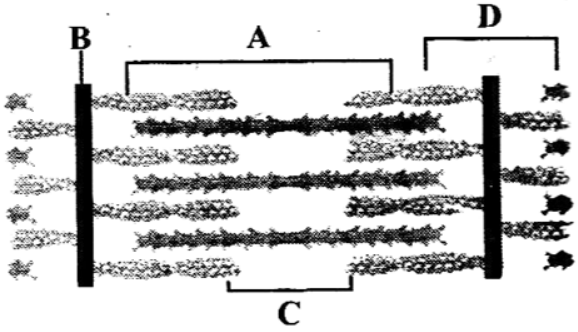
A) All except B and C
B) All except C
C) All except D
D) All except D and E

164.
The given figure is related with mysom monomer (meromysoin). Identify the parts labelled from A to C and select the correct option.



A) A-Head, B-Cross arm, C-GTP binding sites
B) A-Cross arm, B-Head, C-Ca^{+2}binding sites
C) A-Head, B-Cross arm, C-ATP binding sites
D) A-Cross arm, B-Head, C-ATP binding sites

165.
Given below is the figure of a sarcomere. Identify the parts labelled as A to D and select the correct option.



A) A- A band, B-Z line, C-H zone, D-I band
B) A- A band, B-H line, C-Z zone, D-I band
C) A- I band, B-H line, C- Z zone, D-A band
D) A- I band, B- Z line, C-H zone, D- A band

166.
Which of the following statements are correct regarding muscle proteins ? (i) Actin is a thin filament and is made up of two F-actins. (ii) The complex protein, tropomyosin is distributed at regular intervals on the troponin. (iii) Myosin is a thick filament which is also a polymerized protein. (iv) The globular head of meromyosin consists of light meromyosin (LMM).

A) (i), (ii) and (iii)
B) (i), (ii) and (iv)
C) (i) and (iii)
D) (ii) and (iv)

167.
Match Column-I and Column-II and select the correct option from the codes given below.

	Column-I		Column-II
(A)	Structural and functional unit of a myofibril	(A)	H-zone
(B)	Protein of thin filament	(B)	Myosin
(C)	Protein of thick filament	(C)	Sarcomere
(D)	The central part of thick filament not overlapped by thin filament	(D)	Actin

A) A →i; B →ii; C →iii; D →iv
B) A →i; B →iii; C →ii; D →iv
C) A →iii; B →iv; C →i; D →ii
D) A →iii; B →iv; C →ii; D →i

168.

Which of the following statements about the molecular arrangement of actin and myosin in myofibrils is/are incorrect ? i) Each actin (thin filament) is made of 2F (filamentous) actins. ii) F-actin is the polymer of G (globular) actin iii) 2F-actins are twisted into a helix. iv) Two strands of tropomyosin (protein) lie in the grooves of F-actin v) Troponin molecules (complex proteins) are distributed at regular intervals on the tropomyosin. vi) Troponin forms the head of the myosin molecule vii) The myosin is a polymerized protein.

A) (i), (iii) and (vii) **B)** (ii), (iv) and (v)

C) only (vi) **D)** only (iii)

169.

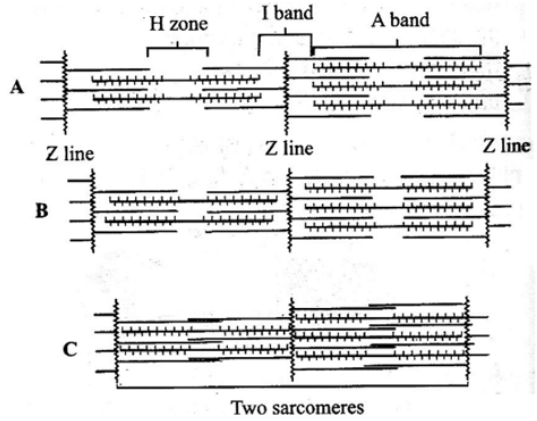
The given figure shows an actin (thin) filament. Identify the labelled parts A, B and C and select the correct option.

A) A – Tropomyosin, B – Troponin, C - F-actin **B)** A – Troponin, B – Myosin, C – Tropomyosin

C) A – Troponin, B – Tropomyosin, C – Myosin **D)** A – Troponin, B – Tropomyosin, C - F-actin

170.

The figures given here represent three different conditions of sarcomeres. Identify these conditions and select the correct option.

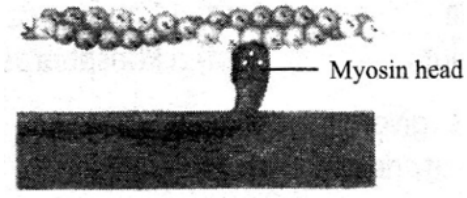


A) A – Contracting, B – Relaxed, C - Maximally contracted **B)** A – Relaxed, B – Contracting, C - Maximally contracted

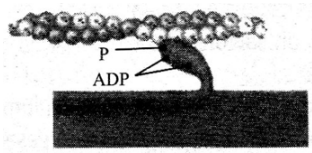
C) A - Maximally contracted, B – Contracting, C – Relaxed **D)** A – Relaxed, B – Contracted, C - Contracting

171.

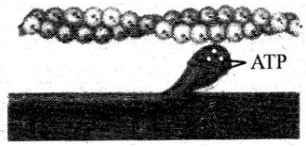
Which one of the following options shows the next stage of muscle contraction after the stage given in question ?



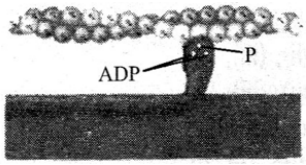
A)



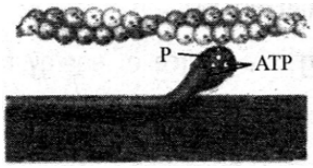
B)



C)



D)



172.

Cardiac/heart muscles are

A) Striated and involuntary **B)** Not fatigued

C) Branched **D)** All

173.

The source of Ca^{+2} for the muscle is

A) T-tubule **B)** Sarcosome

C) Sarcolemma **D)** Sarcoplasmic reticulum

174.

The fascia surrounding a muscle is made up of

A) Cartilage **B)** Collagenous connective tissues

C) Adipose tissue **D)** Blood vessels

175.

Contractile fibrils of muscles are called

A) Neurofibrils **B)** Collagen fibres

C) Myofibrils **D)** Yellow fibres

176.

Myofibrils show alternate dark and lightbands in

A) Cardiac muscles **B)** Smooth muscles

C) Striped muscles **D)** a and c

177.

Which is the smallest one?

A) Muscle fibre **B)** Myofibril

C) Actin **D)** Sarcomere

178.

Z-line divides the myofibrils into

A) Sarcomere **B)** Sarcolemma

C) Sarcosome **D)** Microtubules

179.

Light bands (thin filaments) contain actin and are called

A) A-bands or Isotropic band

B) A-bands or Anisotropic bands

C) I-bands or Isotropic bands

D) I-bands or Anisotropic bands

180.

The functions of tropomyosin in skeletal muscle include

A) Sliding on actin to produce shortening.

B) Release Ca^{+2} after initiation of contraction

C) Acting as "relaxing protein" at rest by covering up the sites where myosin binds to actin

D) Generates ATP

ANSWER KEY

Physics

1.	**4**	13.	**1**	25.	**1**	37.	**2**
2.	**1**	14.	**3**	26.	**2**	38.	**4**
3.	**2**	15.	**4**	27.	**1**	39.	**3**
4.	**3**	16.	**4**	28.	**1**	40.	**3**
5.	**1**	17.	**2**	29.	**4**	41.	**2**
6.	**1**	18.	**3**	30.	**1**	42.	**3**
7.	**4**	19.	**1**	31.	**4**	43.	**3**
8.	**3**	20.	**1**	32.	**1**	44.	**1**
9.	**2**	21.	**3**	33.	**4**	45.	**2**
10.	**4**	22.	**2**	34.	**1**		
11.	**3**	23.	**1**	35.	**1**		
12.	**1**	24.	**1**	36.	**2**		

Chemistry

46.	**4**	58.	**2**	70.	**2**	82.	**2**
47.	**1**	59.	**1**	71.	**2**	83.	**1**
48.	**3**	60.	**1**	72.	**1**	84.	**4**
49.	**3**	61.	**4**	73.	**2**	85.	**3**
50.	**4**	62.	**4**	74.	**3**	86.	**3**
51.	**4**	63.	**1**	75.	**3**	87.	**4**
52.	**3**	64.	**2**	76.	**3**	88.	**4**
53.	**4**	65.	**3**	77.	**4**	89.	**2**
54.	**3**	66.	**1**	78.	**2**	90.	**3**
55.	**1**	67.	**3**	79.	**3**		
56.	**4**	68.	**3**	80.	**1**		
57.	**3**	69.	**2**	81.	**1**		

Botany

91.	**1**	103.	**3**	115.	**1**	127.	**3**
92.	**4**	104.	**3**	116.	**2**	128.	**2**
93.	**3**	105.	**3**	117.	**2**	129.	**2**
94.	**1**	106.	**4**	118.	**1**	130.	**2**
95.	**3**	107.	**2**	119.	**3**	131.	**1**
96.	**4**	108.	**1**	120.	**3**	132.	**2**
97.	**2**	109.	**2**	121.	**2**	133.	**3**
98.	**1**	110.	**2**	122.	**2**	134.	**2**
99.	**4**	111.	**3**	123.	**3**	135.	**4**
100.	**1**	112.	**3**	124.	**2**		
101.	**2**	113.	**1**	125.	**2**		
102.	**4**	114.	**3**	126.	**2**		

Zoology

136.	**1**	138.	**4**	140.	**3**	142.	**1**
137.	**3**	139.	**4**	141.	**2**	143.	**1**

144.	**4**	154.	**2**	164.	**3**	174.	**2**
145.	**2**	155.	**2**	165.	**1**	175.	**3**
146.	**3**	156.	**1**	166.	**3**	176.	**4**
147.	**1**	157.	**1**	167.	**4**	177.	**4**
148.	**1**	158.	**2**	168.	**3**	178.	**1**
149.	**1**	159.	**1**	169.	**4**	179.	**3**
150.	**3**	160.	**4**	170.	**1**	180.	**3**
151.	**3**	161.	**2**	171.	**1**		
152.	**3**	162.	**2**	172.	**4**		
153.	**3**	163.	**3**	173.	**4**		

SOLUTIONS

Q1.

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.

Q2.

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.

Q3.

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.

Q4.

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.

Q5.

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 $1\ \mathrm{V}$.

Q6.

Answer: A

Explanation:

The circuit consists of two parallel paths from P to R. Path 1 is the direct wire PR, and Path 2 is the combination of wires PQ and QR in series. Current divides inversely to the resistance of each path.

Q7.

Answer: D

Explanation:

Using the principles of nodal analysis, the potential at A is determined by the potential drop across the first resistor ($V_A = 4V$), while the potential at D is found by calculating the drop to point C ($V_C = -6V$) and then accounting for the 3V potential gain from the battery connected between C and D,.

Q8.

Answer: C

Explanation:

The total current drawn from the25 V 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 the25 V source, meaning their potentials add up.

Q9.

Answer: B

Explanation:
The balance condition for a Wheatstone bridge is determined by the ratio of the resistances in its four arms, represented as $\frac{P}{Q} = \frac{R}{S}$. The arms containing the battery and the galvanometer are known as conjugate arms. Interchanging the positions of the battery and the galvanometer does not affect the mathematical requirement for the bridge to be balanced; therefore, if the bridge was at a null point, it will remain at a null point.

Q10.

Answer: D

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.

Q11.

Answer: C

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.

Q12.

Answer: A

Explanation:

The potential difference between points B and D is determined by the electric potential at each point relative to a common reference, such as terminal C. Since the branches ABC and ADC are in parallel across the $6\ \mathrm{V}$ source, each branch acts as a voltage divider. If the ratio of the resistances in the upper branch equals the ratio in the lower branch ($5/15 = 10/30$), the bridge is balanced. In a balanced condition, points B and D are at the same potential, resulting in a potential difference of zero.

Q13.

Answer: A

Explanation:

Since the bridge is balanced, no current flows through the central galvanometer branch. The circuit simplifies to two parallel arms. The 2 A input current at P divides between the top arm ($4 + 2\Omega$) and the bottom arm ($10 + 5\Omega$).

Q14.

Answer: C

Explanation:

The fundamental balance condition for a Wheatstone bridge is that the ratio of resistances in adjacent arms must be equal, represented as $\frac{P}{Q} = \frac{R}{S}$. By cross-multiplying this ratio, we derive the equilibrium equation where the product of the resistances in opposite arms is equal.

Q15.

Answer: D

Explanation:

In option D, the left and right 3Ω resistors are connected in series with a combination of three 3Ω resistors in parallel. The equivalent resistance of the parallel combination is 1Ω. Therefore, the total equivalent resistance is $3 + 1 + 3 = 7\Omega$. Hence, option D gives the required total resistance of 7Ω.

Q16.

Answer: D

Explanation:
The equivalent resistance of a circuit depends on how the individual components are branched. By placing the 2Ω and 3Ω resistors in parallel and then adding the 1Ω resistor in series to that entire combination, the resulting fractional resistance is $\frac{11}{5}\Omega$.

Q17.

Answer: B

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.

Q18.

Answer: C

Explanation:
We calculate the equivalent resistance of the parallel combination and then use Ohm's Law ($I = V/R$) to find the total current drawn from the20Vsource.

Q19.

Answer: A

Explanation:
The operation of a meter bridge is based on the balanced Wheatstone bridge principle, where the ratio of resistances in the gaps is equal to the ratio of the lengths of the bridge wire segments: $\frac{X}{R} = \frac{l}{100-l}$. For metallic conductors, electrical resistance increases as the temperature increases. Therefore, heating the conductor in the left gap increases its resistance, requiring an increase in the balancing length to maintain the equilibrium of the bridge.

Q20.

Answer: A

Explanation:

A meter bridge works on the principle of the Wheatstone bridge. At null deflection, the ratio of the resistances in the two gaps equals the ratio of the lengths of the corresponding wire segments ($\frac{R_{left}}{R_{right}} = \frac{l}{100-l}$).

Q21.

Answer: C

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.

Q22.

Answer: B

Explanation:
By applying the meter bridge balance condition, we first determine the total resistance of the wire in the left gap. Once the total resistance for the $1\ \mathrm{m}$ wire is known, we can calculate the specific length required to provide exactly 1Ω of resistance.

Q23.

Answer: A

Explanation:

Increasing the resistance R in the primary circuit of a potentiometer decreases the total current flowing through the wire AB. This reduction in current lowers the potential drop per unit length (potential gradient) across the wire. Consequently, a longer portion of the wire is required to balance the same external EMF, causing the balance point to shift further from the starting pointA.

Q24.

Answer: A

Explanation:

For a potentiometer, the EMF of a cell is directly proportional to the balancing length ($E \propto L$) when the potential gradient is constant. Therefore, we use the ratio $\frac{E_1}{E_2} = \frac{L_1}{L_2}$.

Q25.

Answer: A

Explanation:
In a potentiometer, the potential drop across the wire is proportional to the length of the wire ($V \propto l$). Therefore, the ratio of the e.m.f.s is equal to the ratio of the balancing lengths.

Q26.

Answer: B

Explanation:

We first find the total current in the main circuit, then the potential difference across the potentiometer wire to find the potential gradient ($k = V/L$). Finally, we find the length corresponding to the2.4V source using $L = E/k$.

Q27.

Answer: A

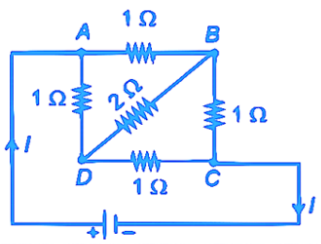
Explanation:
First, we determine the potential gradient (k) required to balance 10mV at 40cm. Then, we relate this gradient to the main circuit parameters (total EMF, total resistance) to solve for the unknown series resistance.

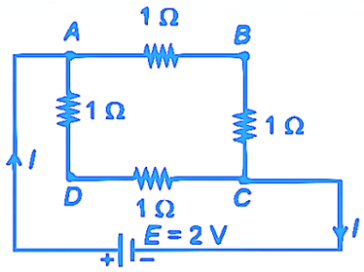
Q28.

Answer: A

Explanation:

→ Each side will have resistance of 1Ω → It is balanced wheat stone bridge → No current in the resistance of 2Ω
→ $[R_{\text{effective}}]_{AC} = 1\Omega \rightarrow \quad I = \frac{E}{R_{\text{eff.}}} = \frac{2}{1} \rightarrow \quad I = 2\ \text{A}$

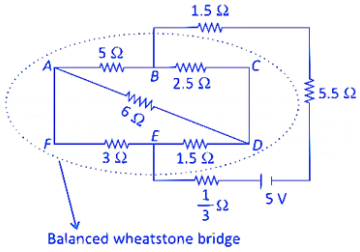




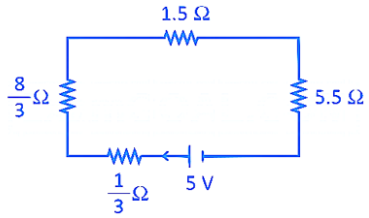
Q29.

Answer: D

Explanation:



$\therefore$ its equivalent $R' = \frac{4\times8}{12} = \frac{8}{3}\Omega$ Circuit can be redrawn as



$\text{R}_{\text{eq}} = \frac{8}{3} + \frac{1}{3} + 1.5 + 5.5 = 10\Omega\ i = \frac{V}{\text{R}_{\text{eq}}} = \frac{5}{10} = 0.5\ \text{A}$

Q30.

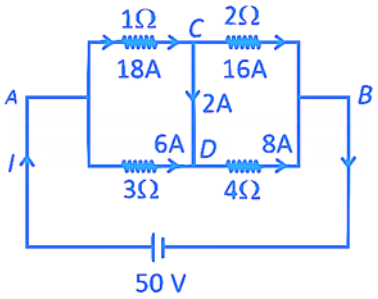
Answer: A

Explanation:
After cutting the wire into 8 equal pieces: Resistance of each piece: Each piece has a resistance $R' = \frac{R}{8}$. Parallel Combination in Each Set: Each set consists of 4 pieces connected in parallel: Resistance of each set: $R'' = \frac{R'}{4} = \frac{R}{32}$ Connecting the Sets in Series: With both sets connected in series, the equivalent resistance is calculated as: $R_{\text{eq}} = R'' + R'' = 2 \times \frac{R}{32} = \frac{R}{16}$ Thus, the net effective resistance of the combination is $\frac{R}{16}$.

Q31.

Answer: D

Explanation:



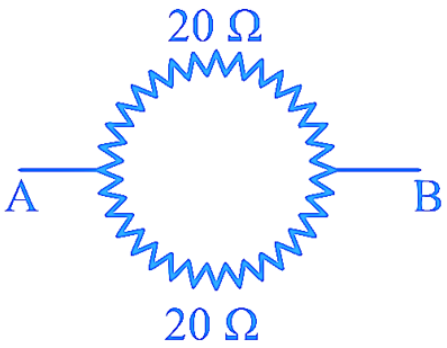
$R_{AB} = (1\Omega/3\Omega) \text{ in series with } (2\Omega/4\Omega) = \frac{3\times1}{3+1} + \frac{2\times4}{2+4}$
$= \frac{3}{4} + \frac{8}{6} = \frac{9+16}{12} = \frac{25}{12}\Omega$ Now total current through cell
$I = \frac{50}{25/12} = 24\ \text{A}$
$I_{1\Omega} = \frac{3}{4} \times 24 = 18\ \text{A}, I_{3\Omega} = \frac{1}{4} \times 24 = 6\ \text{A}$
$I_{2\Omega} = \frac{4}{6} \times 24 = 16\ \text{A}, I_{4\Omega} = \frac{2}{6} \times 24 = 8\ \text{A}$ Using junction rule at $C, I_{CD} = 18 - 16 = 2\ \text{A}$ (From C to D)

Q32.

Answer: A

Explanation:

$R_0 = 10\Omega$ After stretching its length upto2l $R_1 = n^2 R_0 = 4R_0 = 40\Omega$

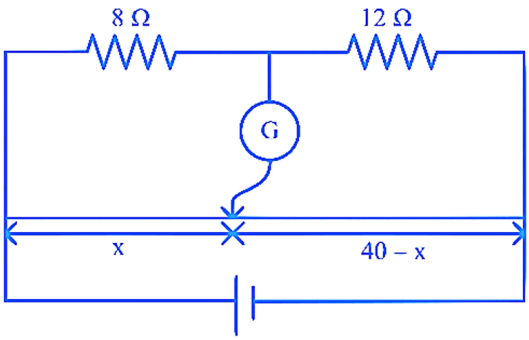


$R_{AB} = \frac{20\times20}{20+20} = 10\Omega$

Q33.

Answer: D

Explanation:



$\frac{8}{x} = \frac{12}{40-x}$ $\frac{2}{x} = \frac{3}{40-x}$ $80 - 2x = 3x$ $16 = x$ from B $= 40 - 16 = 24$ cm

Q34.

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.

Q35.

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.

Q36.

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 $(6\Omega + 8\Omega) = 14\Omega$.

Q37.

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 V) connected to the branches, the potential at node A is equal to the potential at node B. Therefore, the potential difference $V_{AB} = V_A - V_B = 0$ V.

Q38.

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 $R_{AC} = \frac{15}{11}r$.

Q39.

Answer: C

Explanation:

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

Q40.

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.

Q41.

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 $R_{eq} = \frac{7}{6}R$.

Q42.

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.

Q43.

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 $I_2 > I_1 > I_3$.

Q44.

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 $R_{eq} = \frac{2Rr}{R+r}$.

Q45.

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.

Q46.

Answer: D

Explanation:

The conversion of 2-bromo-pentane to pent-2-ene involves the removal of a hydrogen atom from the β-carbon and a bromine atom from the α-carbon (dehydrohalogenation). Since the more substituted alkene (pent-2-ene) is the major product, it follows Zaitsev's rule.

Q47.

Answer: A

Explanation:

Reaction (i) involves the removal of HBrto form an unsaturated alkene, which is an elimination. Reaction (ii) involves the replacement of a bromine atom with a hydroxyl group, which is a substitution. Reaction (iii) involves the adding of Br_2 across a double bond, which is an addition reaction.

Q48.

Answer: C

Explanation:

Heating a secondary alkyl halide like 2-bromopentane with a strong base (C_2H_5OK) in a protic solvent favors elimination over substitution. According to Zaitsev's rule, the more substituted alkene (pent-2-ene) is the major product, and the trans-isomer is more stable than thecis-isomer.

Q49.

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.

Q50.

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.

Q51.

Answer: D

Explanation:

The reaction of m-bromoanisole with sodamide ($NaNH_2$) involves an elimination-addition mechanism via a benzyne intermediate. The methoxy group directs the incoming nucleophile (NH_2^-) to the metaposition, resulting in 3-methoxyaniline as the product.

Q52.

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.

Q53.

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.

Q54.

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.

Q55.

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).

Q56.

Answer: D

Explanation:
When a tertiary (3°) alkyl halide like t-butyl bromide reacts with a strong base/nucleophile like sodium methoxide, elimination is the exclusive pathway. The methoxide ion acts as a base and abstracts a β-hydrogen, resulting in the formation of an alkene.

Q57.

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.

Q58.

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.

Q59.

Answer: A

Q60.

Answer: A

Explanation:

This is an intramolecular Friedel-Crafts alkylation. The anhydrous $AlCl_3$ generates a carbocation at the end of the alkyl chain. The aromatic ring then undergoes electrophilic substitution, closing the ring. The methyl group from the secondary halide remains at the site of the new ring junction.

Q61.

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.

Q62.

Answer: D

Explanation:

The combination of NaOHand ethanol (C_2H_5OH) forms ethoxide ions, which promoteE2 elimination. In a cyclic system with an existing double bond, the elimination of HCl leads to the formation of a conjugated diene, which is thermodynamically more stable.

Q63.

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.

Q64.

Answer: B

Q65.

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 ($AlBr_3$), the bromine is directed to the metaposition of the benzene ring.

Q66.

Answer: A

Explanation:

E_1 reactions proceed via a carbocation intermediate. The rate depends on the stability of this carbocation. Allylic carbocations are resonance-stabilized and significantly more stable than secondary or primary alkyl carbocations.

Q67.

Answer: C

Explanation:

The Saytzeff rule states that the more substituted alkene is the major product. This is generally favored by small bases. However, if a bulky base like potassium tertiary-butoxide (used in reaction 3) is used, steric hindrance prevents it from reaching the more substituted carbon, resulting in the Hoffman product (less substituted alkene) instead.

Q68.

Answer: C

Explanation:

This is anE1elimination reaction. The iodine leaves to form a secondary carbocation. A 1,2-hydride shift occurs to form a more stable tertiary carbocation. The subsequent loss of a proton yields the most substituted (Saytzeff) alkene.

Q69.

Answer: B

Explanation:

In E_2 elimination, the most acidic hydrogen is abstracted. In 3-bromo-2-fluoropentane, the hydrogen on C_2 is the most acidic because it is adjacent to the highly electronegative fluorine atom (-Ieffect). Its removal, along with the leaving of the bromide ion from C_3, results in an alkene where the fluorine is attached to the double bond.

Q70.

Answer: B

Explanation:

Reaction (1) is a hydrolysis in water, which for a tertiary halide follows the S_N1 mechanism. The rate of S_N1 depends only on the concentration of the substrate. Reaction (2) in ethanol favors E2 elimination, where the rate depends on both the substrate and the base concentration.

Q71.

Answer: B

Explanation:

S_N2 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 $-M$ or $-I$ effects more effectively.

Q72.

Answer: A

Explanation:

The reaction sequence involves two successive eliminations. Alcoholic KOH removes the first equivalent of HBr to form a vinyl bromide. The much stronger base $NaNH_2$ is then required to eliminate the second equivalent of HBr from the hindered vinyl position, resulting in a terminal alkyne.

Q73.

Answer: B

Explanation:
Free radical bromination is highly selective and occurs at the position that forms the most stable radical. The allylic position (γ-carbon) allows the resulting radical to be stabilized by resonance with the adjacent double bond.

Q74.

Answer: C

Explanation:

In a polar protic solvent like methanol, a secondary allylic bromide undergoes S_N1 solvolysis. The bromide ion leaves to form a secondary allylic carbocation, which then rearranges (resonance) to form a more stable tertiary allylic carbocation. The nucleophile (CH_3OH) then attacks the more stable site.

Q75.

Answer: C

Explanation:

The substrate is a secondary alkyl halide. While NaOMe is a strong nucleophile, the β-carbon is quaternary (bearing two methyl groups), creating significant steric hindrance for S_N2. Thus, E2 elimination occurs at the other available β-carbon (the CH_2 group), forming an alkene.

Q76.

Answer: C

Explanation:

Sodium ethoxide (C_2H_5ONa) .is a strong base that facilitates anE2 elimination reaction. In this specific substrate, the hydrogen at the benzylic position is more acidic due to the $-I$ effect of the phenyl ring, and its removal results in a double bond conjugated with the aromatic ring, which is thermodynamically favored.

Q77.

Answer: D

Explanation:

The reaction involves double dehydrohalogenation using alcoholic KOH and heat. The process follows the Saytzeff rule, which states that the more substituted alkene is the major product. Additionally, the formation of a conjugated diene provides extra stability through resonance.

Q78.

Answer: B

Explanation:

Elimination is highly favored when a bulky base like potassium tert-butoxide ($t-BuOK$) is used at high temperatures. The reaction results in the loss of HBr to form stilbene, a highly stable conjugated aromatic alkene.

Q79.

Answer: C

Q80.

Answer: A

Explanation:
This is a dehydrohalogenation (E2) reaction. The double bond forms between the carbons such that it is in conjugation with the phenyl group, which significantly lowers the energy of the product and makes it the major species.

Q81.

Answer: A

Explanation:
The reaction of an alkyl halide with alcoholic potash (KOH) induces dehydrohalogenation, which is a\beta-elimination process. In the case of1-chlorobutane, the chlorine atom and a hydrogen atom from the adjacentβ-carbon are removed to form a double bond.,

Q82.

Answer: B

Explanation:
Treatment of a primary alkyl halide like n-propyl bromide with ethanolic (alcoholic) KOH results in an E_2 elimination reaction. The removal of HBrfrom the molecule leads to the formation of an unsaturated hydrocarbon.,

Q83.

Answer: A

Q84.

Answer: D

Explanation:
The S_N2 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.,

Q85.

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.,

Q86.

Answer: C

Explanation:
Elimination from 3-bromo-3-cyclopentylhexane can occur at multiple β-carbon positions. The total count must include all distinct structural isomers and their respective geometrical isomers (E and Z configurations)

Q87.

Answer: D

Q88.

Answer: D

Explanation:
Reactivity in nucleophilic substitution is significantly influenced by the ability of the leaving group to depart. The strength of the carbon-halogen bond and the stability of the resulting halide ion determine this order.,

Q89.

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.,

Q90.

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.,

Q91.

Answer: A

Q92.

Answer: D

Q93.

Answer: C

Q94.

Answer: A

Q95.

Answer: C

Q96.

Answer: D

Q97.

Answer: B

Q98.

Answer: A

Q99.

Answer: D

Q100.

Answer: A

Q101.

Answer: B

Q102.

Answer: D

Q103.

Answer: C

Q104.

Answer: C

Q105.

Answer: C

Q106.

Answer: D

Q107.

Answer: B

Q108.

Answer: A

Q109.
Answer: B

Q110.
Answer: B

Q111.
Answer: C

Q112.
Answer: C

Q113.
Answer: A

Q114.
Answer: C

Q115.
Answer: A

Q116.
Answer: B

Q117.
Answer: B

Q118.
Answer: A

Q119.
Answer: C

Q120.
Answer: C

Q121.
Answer: B

Q122.
Answer: B

Q123.
Answer: C

Q124.
Answer: B

Q125.
Answer: B

Q126.
Answer: B

Q127.
Answer: C

Q128.
Answer: B

Q129.
Answer: B

Q130.
Answer: B

Q131.
Answer: A

Q132.
Answer: B

Q133.
Answer: C

Q134.
Answer: B

Q135.
Answer: D

Q136.
Answer: A

Q137.
Answer: C

Q138.
Answer: D

Q139.
Answer: D

Q140.
Answer: C

Q141.
Answer: B

Q142.
Answer: A

Q143.
Answer: A

Q144.
Answer: D

Q145.
Answer: B

Q146.
Answer: C

Q147.
Answer: A

Q148.
Answer: A

Q149.
Answer: A

Q150.
Answer: C

Q151.
Answer: C

Q152.
Answer: C

Q153.
Answer: C

Q154.
Answer: B

Q155.
Answer: B

Q156.
Answer: A

Q157.
Answer: A

Q158.
Answer: B

Q159.
Answer: A

Q160.
Answer: D

Q161.
Answer: B

Q162.
Answer: B

Q163.
Answer: C

Q164.
Answer: C

Q165.
Answer: A

Q166.
Answer: C

Q167.
Answer: D

Q168.
Answer: C

Q169.
Answer: D

Q170.
Answer: A

Q171.
Answer: A

Q172.
Answer: D

Q173.
Answer: D

Q174.
Answer: B

Q175.
Answer: C

Q176.
Answer: D

Q177.
Answer: D

Q178.
Answer: A

Q179.
Answer: C

Q180.
Answer: C