ICON Educational Institutions
JEE (Mains & Advanced) & NEET

Max Marks: 720 | **SR_WEEK-2 (22-06-2026)** | **Time: 180 mins**

Physics

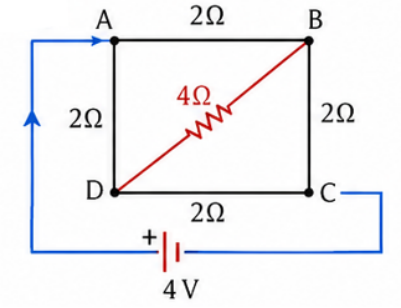
1. A battery of emf 15 V and internal resistance 3 Ω is connected to an external resistor. If the current flowing through the circuit is 0.5 A, what is the terminal voltage of the battery?

A) 13.5 V **B)** 15 V
C) 16.5 V **D)** 12 V

2. A storage battery has an emf of 24 V and an internal resistance of 0.5 Ω. When this battery is connected to a load, the current in the circuit is 4 A. Calculate the terminal voltage of the battery.

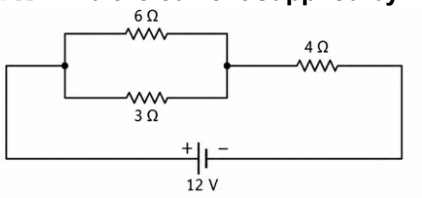
A) 20 V **B)** 24 V
C) 28 V **D)** 22 V

3. A uniform metallic wire having total resistance 8Ω is bent to form a square loop ABCD. Hence each side has resistance 2Ω. A resistor of 4Ω is connected between points B and D. A battery of 4 V is connected across points A and C as shown. Find the current supplied by the battery.



A) 1 A **B)** 2 A
C) 4 A **D)** 8 A

4. In the circuit shown, a 12 V battery is connected across a network. Two resistors of $6\ \Omega$ and $3\ \Omega$ are connected in parallel. This parallel combination is connected in series with a resistor of $4\ \Omega$. Find the current supplied by the battery.



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

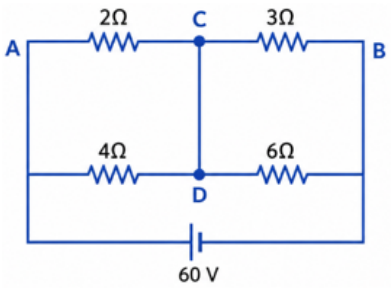
5. A wire of resistance R is cut into 4 equal pieces. These 4 pieces are connected in parallel to form a set. What is the equivalent resistance of this combination?

A) $R/16$ **B)** $R/4$
C) R **D)** 4R

6. A wire of resistance 16 Ω is cut into 2 equal pieces. These 2 pieces are then connected in parallel. This parallel combination is then connected in series with a resistor of 2 Ω. What is the net resistance of the circuit?

A) 4 Ω **B)** 6 Ω
C) 18 Ω **D)** 8 Ω

7. A constant voltage of 60 V is maintained between points A and B of the circuit shown. Between A and C there is a resistor of 2Ω, between C and B a resistor of 3Ω, between A and D a resistor of 4Ω, and between D and B a resistor of 6Ω. Points C and D are connected by an ideal wire. Find the current through branch CD.



A) 1.0 A **B)** 0
C) 3.0 A **D)** 4.0 A

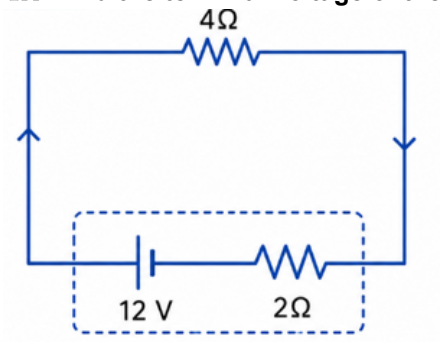
8. **A uniform metal wire of length L has a resistance of 20 Ω. The wire is stretched uniformly until its length becomes 3L. What is the new resistance of the wire?**

A) 60 Ω **B)** 120 Ω
C) 180 Ω **D)** 20 Ω

9. **A wire with a resistance of 100 Ω is stretched to double its original length and then cut into two equal halves. These two halves are then connected in parallel. What is the equivalent resistance of this new combination?**

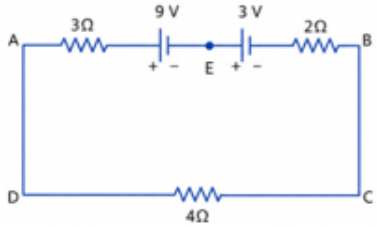
A) 50 Ω **B)** 100 Ω
C) 25 Ω **D)** 200 Ω

10. **The terminal voltage of a battery having emf $12\ \text{V}$ and internal resistance 2Ω is measured when it is connected to an external resistor of 4Ω. Find the terminal voltage of the battery.**



A) $4\ \text{V}$ **B)** $6\ \text{V}$
C) $8\ \text{V}$ **D)** $12\ \text{V}$

11. **The magnitude and direction of the current in the following circuit is to be determined. A single closed loop contains a 3Ω resistor, a $9\ \text{V}$ cell, a $3\ \text{V}$ cell, a 2Ω resistor, and a 4Ω resistor. The two cells oppose each other. The positive terminals of both cells face the same direction. Determine the current and its direction.**

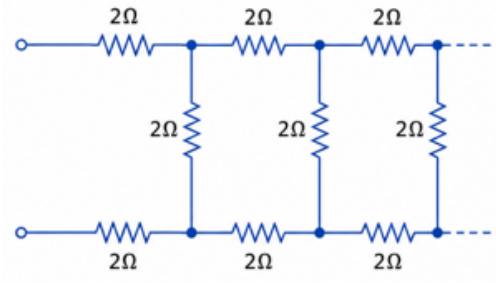


A) $1\ \text{A}$ from A to B **B)** $0.5\ \text{A}$ from A to B
C) $1\ \text{A}$ from B to A **D)** $2\ \text{A}$ from A to B

12. **Five resistors, each of resistance R, are connected in series to a battery of EMF E and negligible internal resistance. If these resistors are instead connected in parallel to the same battery, the current increases by a factor of n. The value of n is:**

A) 5 **B)** 10
C) 25 **D)** D)50

13. **The equivalent resistance of the infinite ladder network shown below is to be found. Each horizontal resistor has resistance 2Ω and each vertical resistor has resistance 2Ω. The pattern repeats infinitely to the right.**



A) $2\sqrt{3}, \Omega$ **B)** $(2+2\sqrt{2}), \Omega$
C) $(2+2\sqrt{3}), \Omega$ **D)** $4, \Omega$

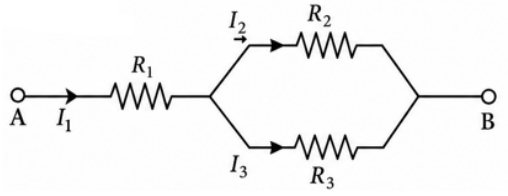
14. **Three identical wires, each having a resistance of 9Ω, are connected in parallel. If these three wires are reconnected in series, what will be the effective resistance of the combination?**

A) 3Ω **B)** 9Ω
C) 81Ω **D)** 27Ω

15. **Two resistors of equal resistance R are connected in parallel, resulting in an effective resistance of 2Ω. What would be the effective resistance if these two resistors were connected in series?**

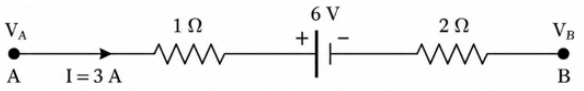
A) 2Ω **B)** 4Ω
C) 8Ω **D)** 16Ω

16. **Three resistors having resistances R_1, R_2 and R_3 are connected as follows. Resistor R_1 is connected in series with a parallel combination of R_2 and R_3. If the current entering the circuit is I_1 and the current through resistor R_2 is I_2, then the ratio $\frac{I_2}{I_1}$ is:**



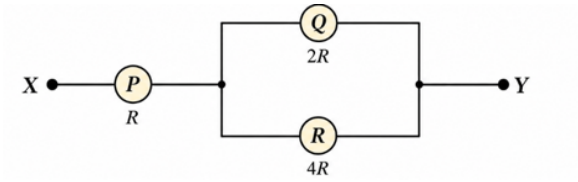
A) $\frac{R_3}{R_2+R_3}$ **B)** $\frac{R_2}{R_2+R_3}$
C) $\frac{R_1}{R_2+R_3}$ **D)** $\frac{R_3}{R_1+R_2}$

17. The potential difference $(V_A - V_B)$ between points A and B in the given figure is to be determined. A current of $3\ \text{A}$ flows from A to B through a 1Ω resistor, a $6\ \text{V}$ cell (with positive terminal on the left and negative terminal on the right), and a 2Ω resistor connected in series.



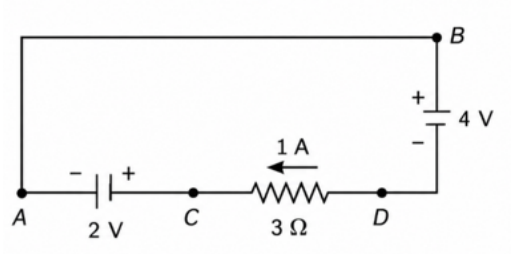
A) $+3\ \text{V}$ **B)** $+15\ \text{V}$
C) $-3\ \text{V}$ **D)** $+12\ \text{V}$

18. Three voltmeters P, Q and R have resistances R, 2R and 4R respectively. They are connected as shown: Voltmeter P is connected in series with a parallel combination of voltmeters Q and R between points X and Y. When a potential difference is applied between X and Y, the voltmeter readings are V_P, V_Q and V_R respectively. Then:



A) $V_P > V_Q = V_R$ **B)** $V_P = V_Q = V_R$
C) $V_P < V_Q = V_R$ **D)** $V_P = V_Q > V_R$

19. In the circuit shown in the figure, point A is connected to point C through a cell of emf $2\ \text{V}$ whose positive terminal is towards C. Point C is connected to point D through a resistor of 3Ω carrying a current of $1\ \text{A}$ from D to C. Point D is connected to point B through a cell of emf $4\ \text{V}$ whose positive terminal is towards D. If the potential at point A is taken to be zero, then the potential at point B is:



A) $+3\ \text{V}$ **B)** $-1\ \text{V}$
C) $+1\ \text{V}$ **D)** $-3\ \text{V}$

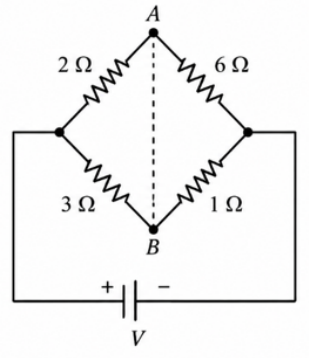
20. Kirchhoff's junction law for electric circuits is a consequence of:

A) Conservation of energy **B)** Conservation of momentum
C) Conservation of charge **D)** Conservation of mass

21. Kirchhoff's loop law for electric circuits is a consequence of:

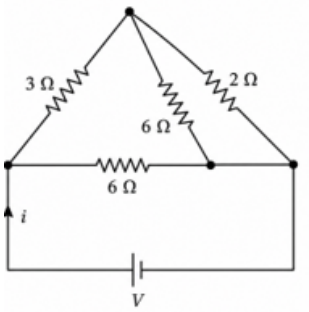
A) Conservation of charge **B)** Conservation of energy
C) Conservation of angular momentum **D)** Newton's law of cooling

22. In the circuit shown, four resistors form a diamond network. The upper-left resistor is 2Ω, the upper-right resistor is 6Ω, the lower-left resistor is 3Ω, and the lower-right resistor is 1Ω. A battery is connected across the left and right junctions. If a conducting wire is connected between points A (top vertex) and B (bottom vertex), the current in this wire will:



A) Flow from A to B **B)** Flow from B to A
C) Be zero **D)** Depend on the value of the battery voltage

23. For the network shown in the figure, the left and right terminals are connected across a battery of voltage V. The network consists of a triangle with resistors: • Left side = 3Ω • Bottom side = 6Ω • Right side = 2Ω A resistor of 6Ω is connected between the top vertex and the bottom-right vertex of the triangle. Find the current i supplied by the battery.



A) $\frac{V}{4}$ **B)** $\frac{V}{6}$
C) $\frac{V}{8}$ **D)** $\frac{V}{10}$

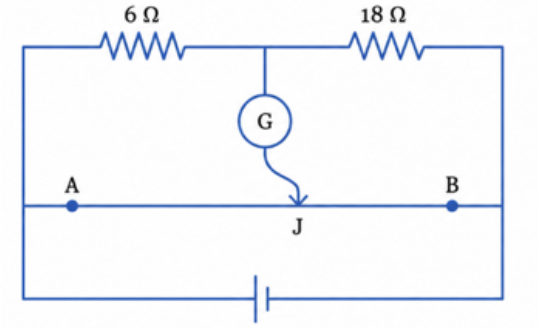
24. A wire of resistance 16Ω is bent into a square loop. The equivalent resistance between two opposite corners of the square is:

A) 2Ω **B)** 4Ω
C) 8Ω **D)** 16Ω

25. A uniform wire of resistance R is cut into four equal pieces and then joined in parallel. The new equivalent resistance is:

A) $R/4$ **B)** $R/8$
C) $R/16$ **D)** R

26. A meter bridge has a uniform wire of length $100\ \text{cm}$. Two resistors of $6\ \Omega$ and $18\ \Omega$ are placed in the left and right gaps respectively. The galvanometer shows zero deflection when the jockey touches the wire at point J. Find the distance of J from the right end of the wire.



A) $25\ \text{cm}$ **B)** $50\ \text{cm}$
C) $75\ \text{cm}$ **D)** $40\ \text{cm}$

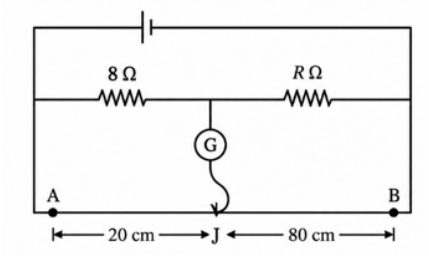
27. In a metre bridge, a resistance wire of length 1.0 m is connected in the left gap, and a resistance of 12 Ω is connected in the right gap. The null point is obtained at a distance of 40 cm from the left end. If the uniform resistance wire has a total resistance of 8 Ω, find the resistance of the wire per unit length.

A) $2\ \Omega/m$ **B)** $4\ \Omega/m$
C) $8\ \Omega/m$ **D)** $6\ \Omega/m$

28. A metre bridge wire has a resistance of 4 Ω per meter. When a resistance X is connected in the left gap and a resistance $Y = 6\Omega$ is connected in the right gap, the null point is found at 60 cm from the left end. What is the value of resistance X?

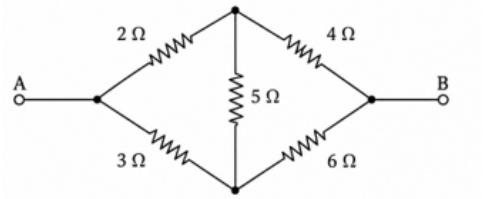
A) $4\ \Omega$ **B)** $6\ \Omega$
C) $9\ \Omega$ **D)** $12\ \Omega$

29. In a meter bridge, the resistances placed in the two gaps are $8\ \Omega$ and $R\ \Omega$ respectively. When the resistance R is shunted by another resistance equal to R, the new balance point is found at $20\ \text{cm}$ from the end near the $8\ \Omega$ resistance. Find the value of R.



A) $16\ \Omega$ **B)** $24\ \Omega$
C) $32\ \Omega$ **D)** $40\ \Omega$

30. The net resistance between points A and B in the given bridge circuit is to be found. The four arms of the diamond are $2\ \Omega$, $3\ \Omega$, $4\ \Omega$, and $6\ \Omega$ respectively, and the central branch has a resistance of $5\ \Omega$.



A) $2\ \Omega$ **B)** $\frac{12}{5}\ \Omega$
C) $3\ \Omega$ **D)** $4\ \Omega$

31. A potentiometer is often referred to as an ideal voltmeter. Why is a potentiometer preferred over a moving coil voltmeter for measuring the electromotive force (e.m.f) of a cell?

A) Because it has a very low resistance and draws no current from the source.
B) Because it uses a null-point method, drawing no current from the cell under measurement.
C) Because it provides a direct reading of the current flowing in the circuit.
D) Because it consumes significant electrical power during the measurement.

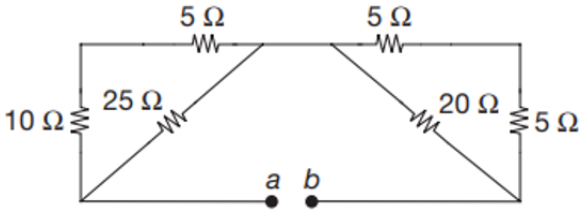
32. In a potentiometer experiment, the balancing length for a cell of e.m.f. 1.5 V is found to be 60 cm. If the cell is replaced by another cell of e.m.f. E', the balancing length is found to be 80 cm. Calculate the value of E'.

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

33. Four resistors of 5Ω each are connected in a Wheatstone bridge configuration. What is the equivalent resistance of the bridge?

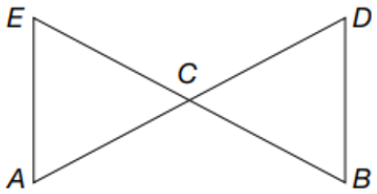
A) 5Ω **B)** 10Ω
C) 2.5Ω **D)** 20Ω

34. Find the equivalent resistance of the circuit given across (a b).



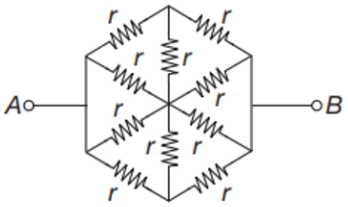
A) $16.1, \Omega$ **B)** $12.5, \Omega$
C) $18.0, \Omega$ **D)** $20.0, \Omega$

35. If resistance of each wire in the network shown is r, the equivalent resistance between A and C is equal to



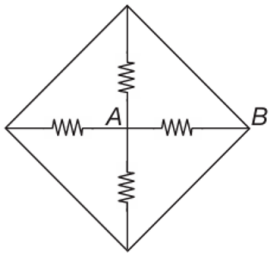
A) r **B)** $\frac{r}{2}$
C) $\frac{2r}{3}$ **D)** $\frac{3r}{2}$

36. The resistance of hexagon circuit between A and B represented in below image



A) r **B)** 0.5 r
C) 2 r **D)** 3 r

37. In the given circuit, each resistor has resistance R. The equivalent resistance between A and B is



A) $R/4$ **B)** 4R
C) C)3/4 R **D)** D)4/3 R

38. In the circuit shown in Fig. 14.8, equivalent resistance between A and B is

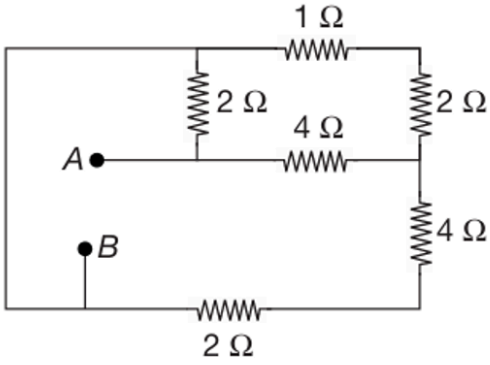
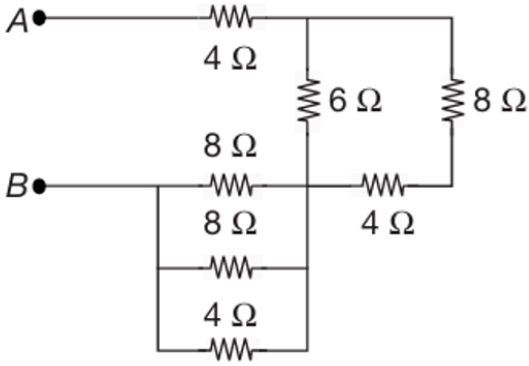


Fig. 14.8

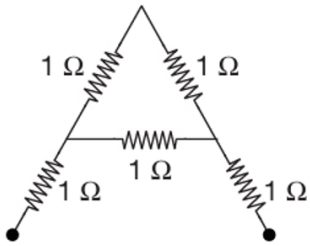
A) 8Ω **B)** 15Ω
C) $3/2\Omega$ **D)** 2Ω

39. The equivalent resistance between points A and B in the circuit shown is



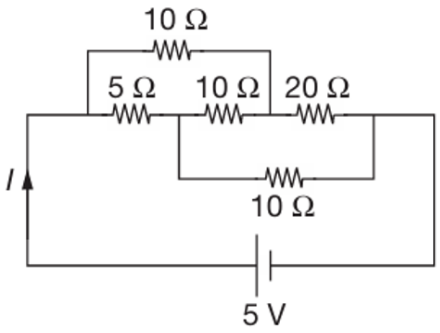
A) 4Ω **B)** 6Ω
C) 10Ω **D)** 8Ω

40. The equivalent resistance of the network shown in Fig. between the base terminals is



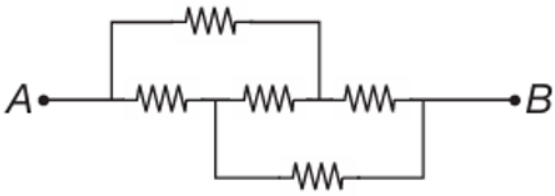
A) 3Ω **B)** $3\frac{1}{2}\Omega$
C) $2\frac{2}{3}\Omega$ **D)** 2Ω

41. The current drawn from the 5 V source will be



A) 0.33 A **B)** 0.5 A
C) 0.67 A **D)** 0.17 A

42. Five equal resistors, each equal to R are connected as shown in Fig. then the equivalent resistance between points A and B is

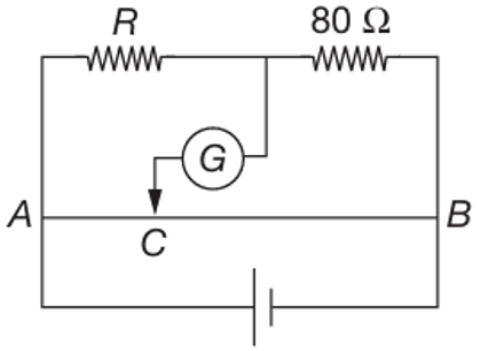


A) R **B)** 5R
C) C)R/5 **D)** D)2R/3

43. Each of the resistance in the network shown in Fig. below is equal to R. The resistance between the terminals A and B is

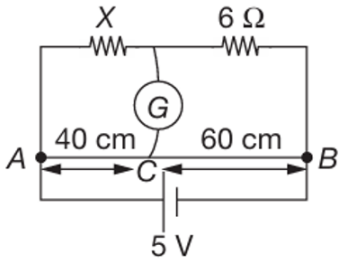
A) R **B)** 5R
C) C)3R **D)** D)5/3 R

44. AB is a wire of uniform resistance. The galvanometer G shows zero current when the length $AC = 20cm$ and $CB = 80cm$. The resistance R is equal to



A) 2Ω **B)** 8Ω
C) 20Ω **D)** 40Ω

45. In the circuit shown, a meter bridge is in its balanced state. The meter bridge wire has a resistance $0.1\Omega/cm$. The value of unknown resistance X and the current drawn from the battery of negligible resistance is

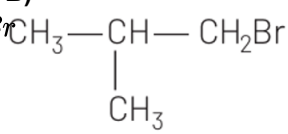


A) $6\Omega, 5A$ **B)** $4\Omega, 0.1A$
C) $4\Omega, 1.0A$ **D)** $12\Omega, 0.5A$

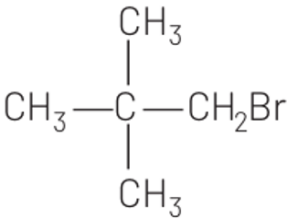
Chemistry

46. In an S_N2 substitution reaction of the type $R - Br + Cl^- \xrightarrow{DMF} R - Cl + Br^-$, which one of the following has the highest relative rate?

A) $CH_3 - CH_2 - CH_2 - Br$ **B)**



C)



D) $CH_3 - CH_2 - Br$

47. Which of the following undergoes nucleophilic substitution exclusively by S_N1 mechanism?

A) Benzyl chloride **B)** Ethyl chloride
C) Chlorobenzene **D)** Isopropyl chloride

48. Reactivity order of halides for dehydrohalogenation is:

A) $R-F > R-Cl > R-Br > R-I$ **B)** $R-I > R-Br > R-Cl > R-F$

C) $R-I > R-F > R-Cl > R-Br$ **D)** $R-F > R-Cl > R-Br > R-I$

49. The alkyl halide is converted into an alcohol by:

A) addition **B)** substitution

C) dehydrohalogenation **D)** elimination

50. When chlorine is passed through propene at $400^{\circ}C$, which of the following is formed?

A) PVC **B)** Allyl chloride

C) Nickel chloride **D)** 1,2-dichloro ethane

51. HBr reacts fastest with:

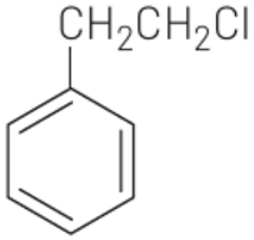
A) 2-methyl propan-1-ol **B)** 2-methyl propan-2-ol

C) propan-2-ol **D)** propan-1-ol

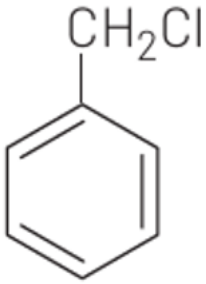
52. Which of the following will not undergo S_N1 reaction with OH^-?

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

C)



D)



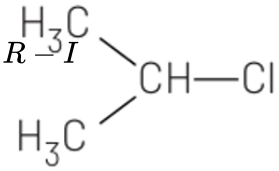
53. Which of the following can be used as the halide component for Friedel-Crafts reaction?

A) Chlorobenzene **B)** Bromobenzene

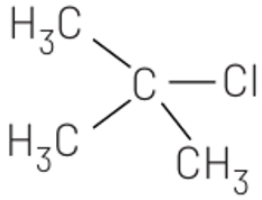
C) Chloroethene **D)** Isopropyl chloride

54. In which of the following compounds, the C—Cl bond ionisation shall give most stable carbonium ion?

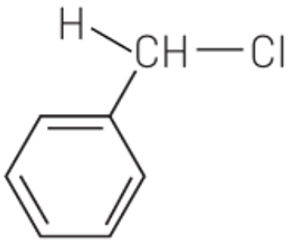
A)



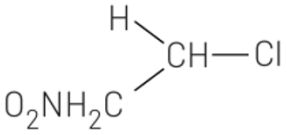
B)



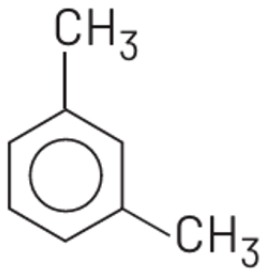
C)



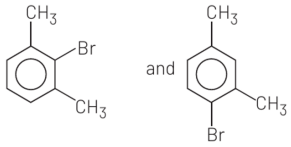
D)



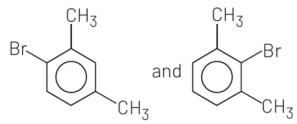
55. What products are formed when the following compound is treated with Br_2 in the presence of $FeBr_3$?



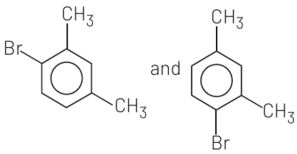
A)



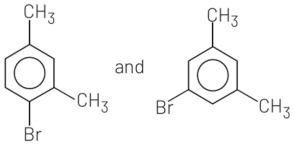
B)



C)



D)



56. Replacement Cl of chlorobenzene to give phenol requires drastic conditions but chlorine of 2, 4-dinitro chlorobenzene is readily replaced. This is because:

A) A)NO_2 makes the ring electron rich at ortho and para-positions

B) B)NO_2 withdraw electrons from meta-position

C) C)NO_2 donates electrons at meta-position

D) D)NO_2 withdraw electrons from ortho/ para-positions

57. The correct statement regarding nucleophilic substitution reaction in a chiral alkyl halide is

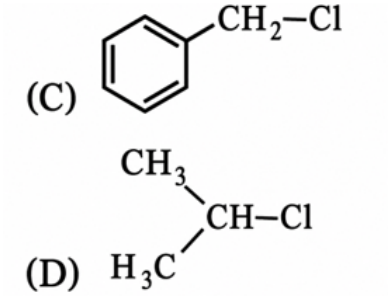
A) Retention occurs in S_N1 reaction and inversion occurs in S_N2 reaction.

B) Racemisation occurs in S_N1 reaction and retention occurs in S_N2 reaction.

C) Racemisation occurs in both S_N1 and S_N2 reactions.

D) Racemisation occurs in S_N1 reaction and inversion occurs in S_N2 reaction.

58. Which among the following halide/s will not show S_N1 reaction: (A) $H_2C = CH - CH_2Cl$ (B) $CH_3 - CH = CH - Cl$



Choose the most appropriate answer from the options given below:

A) (A), (B) and (D) only

B) (A) and (B) only

C) (B) and (C) only

D) (B) only

59. Given below are two statements: Statement - I: High concentration of strong nucleophilic reagent with secondary alkyl halides which do not have bulky substituents will follow S_N2 mechanism. Statement - II: A secondary alkyl halide when treated with a large excess of ethanol follows S_N1 mechanism. In the light of the above statements, choose the most appropriate answer

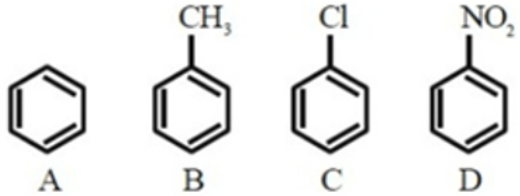
A) Statement I is true but Statement II is false.

B) Statement I is false but Statement II is true.

C) Both statement I and Statement II are false.

D) Both statement I and Statement II are true.

60. The correct order of reactivity in electrophilic substitution reaction of the following compounds is :



A) B > C > A > D

B) D > C > B > A

C) A > B > C > D

D) B > A > C > D

61. Maximum number of isomeric monochloro derivatives which can be obtained from 2,2,5,5tetramethylhexane by chlorination is

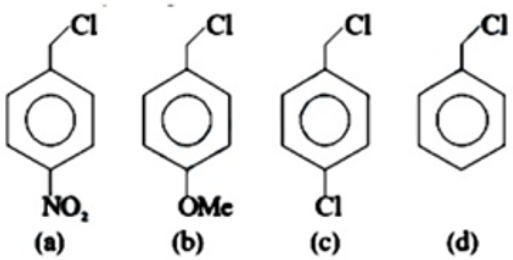
A) 3

B) 9

C) 1

D) 8

62. Decreasing order towards S_N1 reaction for the following compounds is:



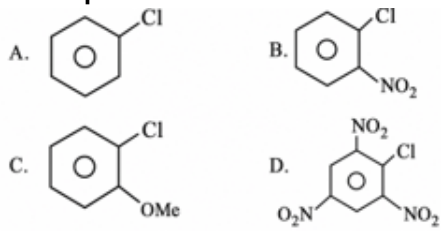
A) a >c>d >b

B) a >b>c>d

C) b >d >c>a

D) d >b>c>a

63. The correct order of reactivity of following haloarenes towards nucleophilic substitution with aqueous NaOH is



Choose the correct answer from the options given below:

A) D > B > A > C

B) A > B > D > C

C) C > A > D > B

D) D > C > B > A

64. 2-Methyl propyl bromide reacts with $C_2H_5O^-$ and gives 'A' whereas on reaction with C_2H_5OH it gives 'B'. The mechanism followed in these reactions and the products 'A' and 'B' respectively are:

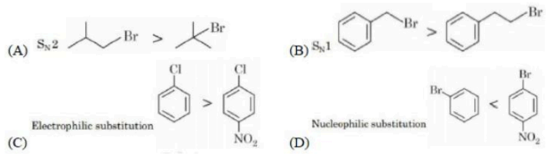
A) S_N1, A = tert-butyl ethyl ether; S_N1, B = 2-butyl ethyl ether

B) S_N2, A = 2-butyl ethyl ether; S_N2, B = iso-butyl ethyl ether

C) S_N, A = iso-butyl ethyl ether; S_N1, B = tert-butyl ethyl ether

D) S_N1, A = tert-butyl ethyl ether; S_N2, B = iso-butyl ethyl ether

65. Choose the correct answer from the options given below:



A) (A), (C) and (D) only

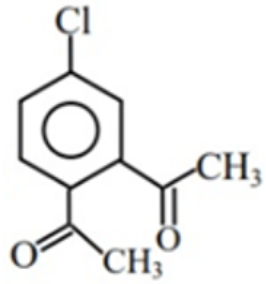
B) (A), (B) and (D) only

C) (B), (C) and (D) only

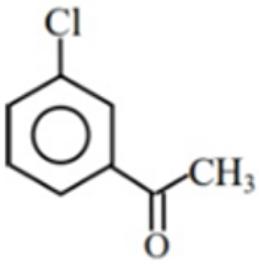
D) (A), (B), (C) and (D)

66. The major product in the Friedel-Craft acylation of chlorobenzene is :

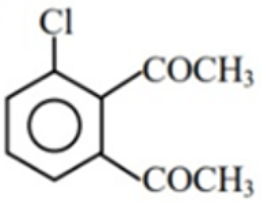
A)



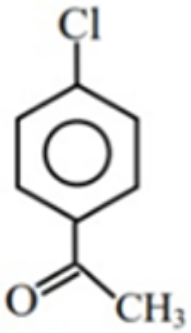
B)



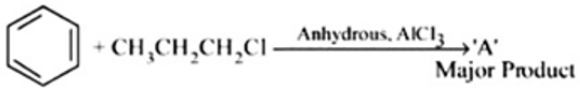
C)



D)



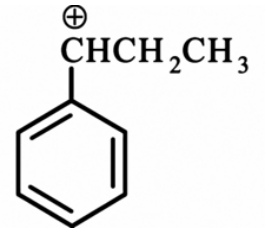
67. The stable carbocation formed in the reaction is:



A) $CH_3CH_2CH_2^+$ **B)** $CH_3CH_2^+$

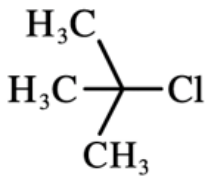
C) $CH_3 - CH^+ - CH_3$

D)

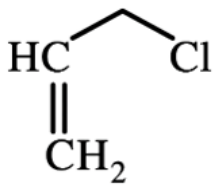


68. Among the following compounds, which one has the shortest $C - Cl$ bond?

A)

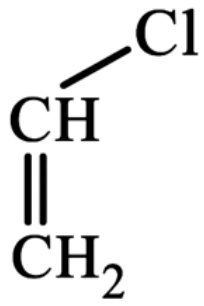


B)

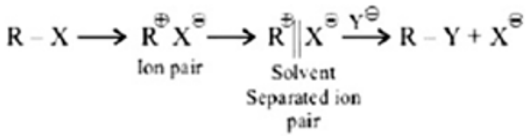


C) $H_3C - CI$

D)



69. The mechanism of S_N1 reaction is given as:



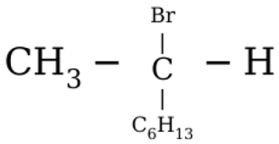
A student writes general characteristics based on the given mechanism: (1) The reaction is favoured by weak nucleophiles. (2) R^+ would be easily formed if the substituents are bulky. (3) The reaction is accompanied by racemization. (4) The reaction is favoured by non-polar solvents. Which observations are correct?

A) (1) and (2) **B)** (1) and (3)

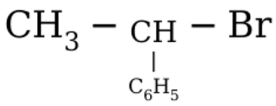
C) (1), (2) and (3) **D)** (2) and (4)

70. Which of the following compounds will show retention in configuration on nucleophilic substitution by OH^- ion?

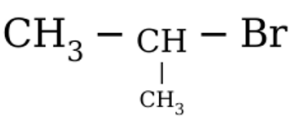
A)



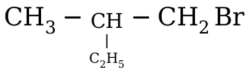
B)



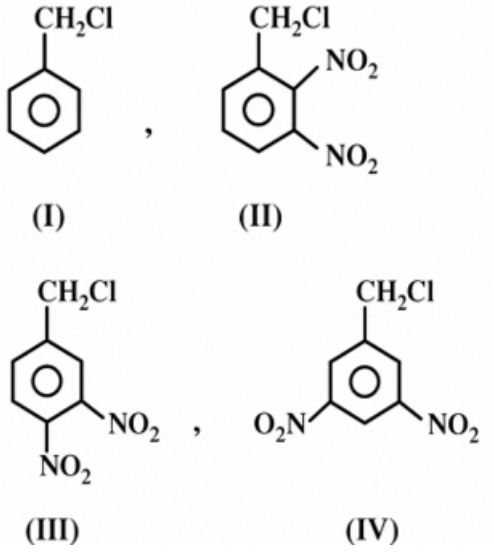
C)



D)



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



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

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

72. Which hydrogen in compound (E) is easily replaceable during bromination reaction in presence of light?

$CH_3(\delta) - CH_2(\gamma) - CH(\beta) = CH_2(\alpha)$ **[Jan. 10,2019(I)]**

A) α-hydrogen **B)** γ-hydrogen

C) δ-hydrogen **D)** β-hydrogen

73. An 'Assertion' and a 'Reason' are given below. Choose the correct answer from the following options: Assertion (A): Vinyl halides do not undergo nucleophilic substitution easily. Reason (R): Even though the intermediate carbocation is stabilized by loosely held π-electrons, the cleavage is difficult because of strong bonding

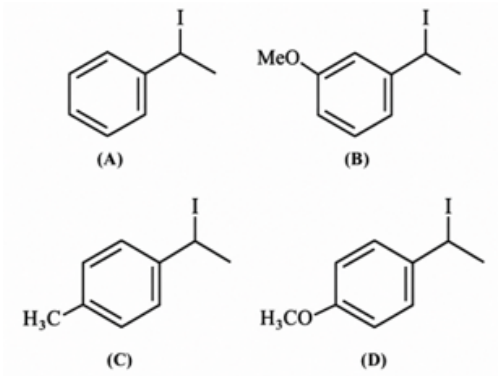
A) Both (A) and (R) are wrong statements.

B) Both (A) and (R) are correct statements and (R) is the correct explanation of (A)

C) Both (A) and (R) are correct statements but (R) is not the correct explanation of (A).

D) (A) is a correct statement but (R) is a wrong statement.

74. Increasing rate of S_N1 reaction in the following compounds is:

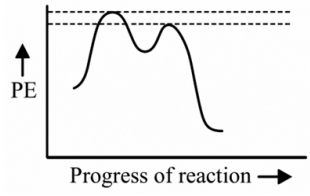


A) (A) < (B) < (C) < (D) **B)** (B) < (A) < (C) < (D)

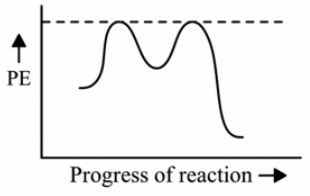
C) (B) < (A) < (D) < (B) **D)** (A) < (B) < (D) < (C)

75. Which of the following potential energy (PE) diagrams represents the S_N1 reaction?

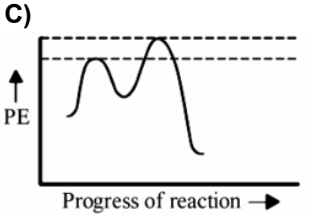
A)



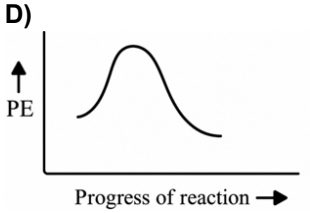
B)



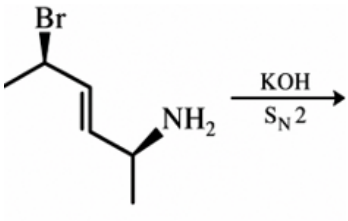
C)



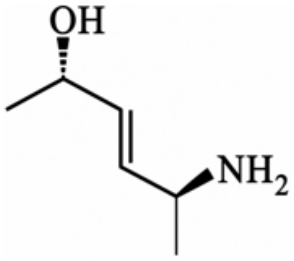
D)



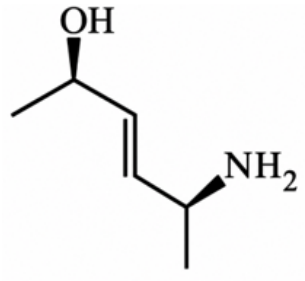
76. The major product of the following reaction is:



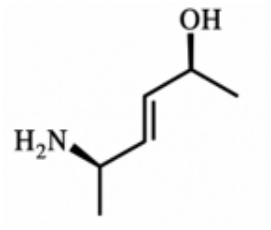
A)



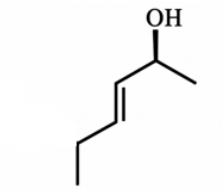
B)



C)



D)



77. The synthesis of alkyl fluorides is best accomplished by:

A) Finkelstein reaction **B)** Swarts reaction

C) Free radical fluorination **D)** Sandmeyer's reaction

78. In S_N2 reactions, the correct order of reactivity for the following compounds: $CH_3Cl, CH_3CH_2Cl, (CH_3)_2CHCl$ and $(CH_3)_3CCl$ is:

A) $CH_3Cl > (CH_3)_2CHCl$

B)

C) $CH_3CH_2Cl > CH_3Cl >$

D)

79. For the compounds CH_3Cl, CH_3Br, CH_3I and CH_3F, the correct order of increasing $C - halogen$ bond length is:

A) $CH_3F < CH_3Cl < CH_3$

B)

C) $CH_3F < CH_3I < CH_3Br <$

D)

80. In a nucleophilic substitution reaction:

$R - Br + Cl^- \xrightarrow{DMF} R - Cl + Br^-$ **which one of the following undergoes complete inversion of configuration?**

A) $C_6H_5CH(C_6H_5)Br$ **B)** $C_6H_5CH_2Br$

C) $C_6H_5CH\,CH_3Br$ **D)** $C_6H_5CH(CH_3)CH_2Br$

81. The order of reactivity of the given haloalkanes towards nucleophile is:

A) $RI > RBr > KCl$ **B)** $RCl > RBr > RI$

C) $RBr > RCl > RI$ **D)** $RBr > RI > RCl$

82. How many chiral compounds are possible on monochlorination of 2-methyl butane?

A) 8 **B)** 2

C) 4 **D)** 6

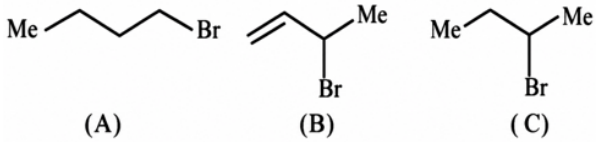
83. The reaction:

$$(CH_3)_3C - Br \xrightarrow{H_2O} (CH_3)_3 - C - OH$$

A) elimination reaction **B)** substitution reaction

C) free radical reaction **D)** displacement reaction.

84. Consider the following bromides:



The correct order of S_N1 reactivity is:

A) B > C > A **B)** B > A > C

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

85. The organic chloro compound, which shows complete stereochemical inversion during a S_N2 reaction, is:

A) $(C_2H_5)_2CHCl$ **B)** $(CH_3)_3CCl$

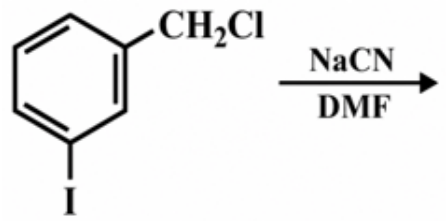
C) $(CH_3)_2CHCl$ **D)** CH_3Cl

86. Which of the following is the correct order of decreasing S_N2 reactivity?

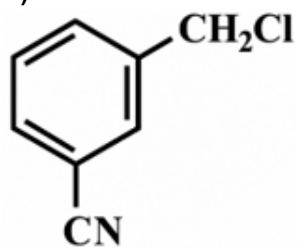
A) $R_2CHX > R_3CX > RCH_2X$ **B)** $RCH_2X > R_3CX > R_2CHX$

C) $RCH_2X > R_2CHX > R_3CX$ **D)** $R_3CX > R_2CHX > RCH_2X$

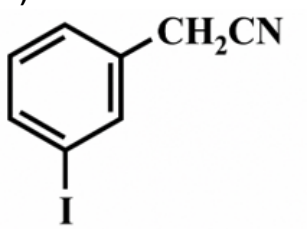
87. The structure of the major product formed in the reaction is:



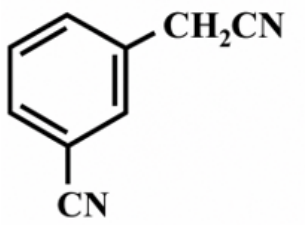
A)



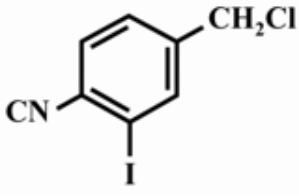
B)



C)



D)



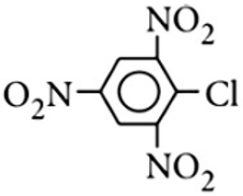
88. Tertiary alkyl halides are practically inert to substitution by S_N2 mechanism because of:

A) steric hindrance **B)** inductive effect

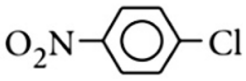
C) instability **D)** insolubility

89. Which chloro derivative of benzene among the following would undergo hydrolysis most readily with aqueous sodium hydroxide to furnish the corresponding hydroxy derivative?

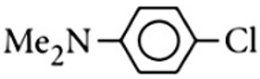
A)



B)



C)



D) C_6H_5Cl

90. Which of the following is an optically active compound?

A) 1 -Butanol **B)** 1 -Propanol

C) 2 -Chlorobutane **D)** 4 -Hydroxyheptane

Botany

91. Which of the following microbes is a proteinaceous infectious agent?

A) Fungi **B)** Prions

C) Bacteria **D)** Protozoa

92. Match column I with column II and select the correct option from the given codes

	Column I		Column II
A.		(i)	Adenovirus
B.		(ii)	Tobacco Mosaic Virus
C.		(iii)	Bacteriophage

A) A-(i), B-(ii), C-(iii)
B) A-(ii), B-(i), C-(iii)
C) A-(iii), B-(ii), C-(i)
D) A-(iii), B-(i), C-(ii)

93. The inoculum is added to the fresh milk in order to convert milk into curd, the term 'inoculum' here refers to:

A) a starter rich in vitamin B_{12}
B) a starter rich in proteins
C) a starter containing millions of LAB
D) an aerobic digester

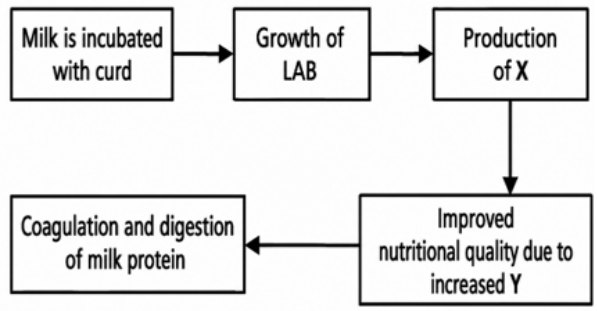
94. Read the following statements and select the incorrect one.

A) The dough used for making dosa and idli is fermented by bacteria.
B) Microbes are used to ferment fish, soybean and bamboo shoots to make food.
C) The large holes in 'Swiss cheese' are due to production of large amount of CO_2 by a fungi called Propionibacterium shermanii.
D) 'Toddy' is a traditional drink of Southern India made by fermentation by microbes.

95. Which one of the following combinations of organisms are responsible for the formation and flavour of yogurt?

A) Lactobacillus bulgaricus and Streptococcus thermophilus
B) Rhizobium meliloti and Azotobacter
C) Bacillus subtilis and Escherichia coli
D) Bacillus megatherium and Xanthomonas sp.

96. Study the following flow chart depicting the formation of curd from milk. Identify the missing parts X and Y.



A) X-Gluconic acid, Y-Vitamin B_1
B) X-Lactic acid, Y-Vitamin B_2
C) X-Lactic acid, Y-Vitamin B_{12}
D) X-Citric acid, Y-Vitamin C

97. Identify the blank spaces A, B, C and D in the following table and select the correct option.

Type of microbe	Scientific name	Commercial product
Bacterium	A	Lactic acid
Fungus	B	Cyclosporin A
Bacterium	*Acetobacter aceti*	C
Fungus	*Penicillium notatum*	D

A) A - Lactobacillus, B - Trichoderma polysporum, C - Acetic acid, D - Penicillin
B) A - Acetobacter, B - Trichoderma polysporum, C - Butyric acid, D - Streptomycin
C) A - Lactobacillus, B - Aspergillus niger, C - Citric acid, D - Penicillin
D) A - Lactobacillus, B - Penicillin , C - Acetic acid, D – Trichoderma polysporum

98. Read the following statements regarding antibiotics and select the incorrect option from codes given below. (i) Antibiotics are the attenuated microorganisms which in small concentration can kill or retard the growth of other harmful microorganisms. (ii) Penicillin was the first antibiotic discovered by Alexander Fleming (1928) while working on bacterium Staphylococcus aureus. (iii) The full potential of penicillin as an effective antibiotic was established by Ernst Chain and Howard Florey. (iv) Fleming, Chain and Florey were awarded the Nobel Prize in 1945.

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

99. Which of the following diseases are treated by antibiotics? (i) Plague (ii) Diphtheria (iii) Leprosy (iv) Whooping cough

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

100.
Select the correct option to fill up the blanks. (i) ___ are used in detergent formulations and are helpful in removing oily stains from the laundry. (ii) ___ are ripened by growing Penicillium roqueforti on them. (iii) ___ are produced without distillation whereas, ___ are produced by distillation of the fermented broth. (iv) ___ antibiotic was used to treat American soldiers wounded in world war II. (v) ___ is also called as kusht rog.

A) (i) Lipases, (ii) Camembert cheese, (iii) Whisky and rum, wine and beer, (iv) Penicillin, (v) Leprosy
B) (i) Lipases, (ii) Roquefort cheese, (iii) Wine and beer, whisky and rum, (iv) Penicillin, (v) Leprosy
C) (i) Streptokinases, (ii) Roquefort cheese, (iii) Wine and beer, whisky and rum, (iv) Streptomycin, (v) Whooping cough
D) (i) Amylases, (ii) Swiss cheese, (iii) Whisky and rum, wine and beer, (iv) Penicillin, (v) Diphtheria

101.
Identify the blank spaces A, B, C and D in the following table and select the correct option.

Type of microbe	Scientific name	Commercial product
Bacterium	A	Streptokinase
B	*Aspergillus niger*	Citric acid
Fungus	*Trichoderma polysporum*	C
Bacterium	D	Butyric acid

A) A-Streptococcus, B-Fungus, C-Cyclosporin A, D-Clostridium butylicum
B) A-Clostridium butylicum, B-Streptococcus, C-Fungus, D-Cyclosporin A
C) A-Streptococcus, B-Yeast, C-Cyclosporin A, D-Lactobacillus
D) A-Streptococcus, B-Cyclosporin A, C-Statins, D-Clostridium butylicum

102.
Statins used for lowering blood cholesterol level are extracted from:

A) algae **B)** bacteria
C) viruses **D)** yeast

103.
Monascus purpureus is a yeast commercially used in the production of:

A) citric acid **B)** ethanol
C) blood cholesterol lowering statins **D)** streptokinase for removing clots from blood vessels.

104.
Which of the following options contains the end products formed during anaerobic respiration in yeast?

A) H_2O, CO_2 and energy **B)** $H_2S, C_6H_{12}O_6$ and energy
C) CO_2, C_2H_5OH and energy **D)** H_2O and CO_2

105.
During the primary treatment of sewage, solid particles that settle down are called:

A) flocs **B)** primary sludge
C) activated sludge **D)** anaerobic sludge

106.
The purpose of biological treatment of waste water is to:

A) reduce BOD **B)** increase BOD
C) reduce sedimentation **D)** increase sedimentation

107.
Read the following statements and select the correct option. Statement 1 : BOD represents the amount of dissolved oxygen that would be consumed if all the organic matter in one litre of water were oxidised by microorganisms. Statement 2 : High value of BOD indicates that water is highly polluted by organic matter.

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 1 and 2 are incorrect.

108.
Sewage water is treated before release into water bodies. The type of microbes used to treat sewage water is:

A) photoautotrophic microbes **B)** chemoautotrophic microbes
C) heterotrophic microbes **D)** symbiotic microbes

109.
Which of the following steps is taken by the Ministry of Environment and Forests to protect rivers from water pollution?

A) Ganga Action Plan
B) Narmada Action Plan
C) Yamuna Action Plan
D) Both (a) and (c)

110.
Match column I with column II and select the correct option from the given codes.

	Column I		Column II
A.	The stage in which physical treatment of sewage is done	(i)	Anaerobic digestion activated sludge and production of biogas
B.	The stage in which biological treatment of sewage is done	(ii)	Activated sludge
C.	Name of the sediment in primary treatment	(iii)	Aeration tanks
D.	It is carried to aeration tanks from primary settling	(iv)	Primary effluent
E.	Name of the sediment in secondary treatment	(v)	Primary sludge
F.	Site of flocs growth	(vi)	Secondary treatment
G.	Function of sludge digester	(vii)	Primary treatment

A) A-(vii), B-(vi), C-(v), D-(iv), E-(ii), F-(iii), G-(i)
B) A-(i), B-(iii), C-(v), D-(vii), E-(ii), F-(iv), G-(vi)
C) A-(i), B-(ii), C-(iii), D-(iv), E-(v), F-(vi), G-(vii)
D) A-(vii), B-(vi), C-(i), D-(ii), E-(iii), F-(iv), G-(v)

111.
BOD is ___ in polluted water and ___ in potable water.

A) more, less
B) less, more
C) less in both
D) medium in both

112.
Select the correct statement regarding activated sludge formed during secondary sewage treatment.

A) A small part of it is rapidly pumped back from sedimentation to aeration tank.
B) It absorbs pathogenic bacteria present in waste water while sinking to the bottom of the settling tank.
C) A major part of it is anaerobically digested.
D) Both (a) and (c)

113.
In the sewage treatment, bacterial flocs are allowed to sediment in a settling tank. This sediment is known as:

A) inactivated sludge
B) activated sludge
C) primary sludge
D) secondary sludge

114.
Methanogens, growing anaerobically on cellulosic material produce:

A) methane
B) methane and carbon dioxide
C) methane and hydrogen
D) methane, carbon dioxide and hydrogen.

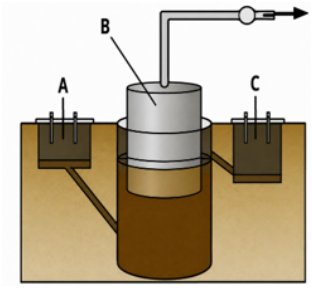
115.
Which of the following bacteria is present in the rumen of cattle?

A) Azotobacter
B) Rhizobium
C) Methanobacterium
D) Azospirillum

116.
Biogas is produced by _____(i) breakdown of biomass with the help of _____(ii) bacteria.

A) (i) anaerobic, (ii) Methanobacterium
B) (i) aerobic, (ii) Rhizobium
C) (i) anaerobic, (ii) Rhizobium
D) (i) aerobic, (ii) Methanobacterium

117.
The given figure represents a typical biogas plant. Select the correct option for A, B and C respectively.



A) A is the inlet for cattle dung.
B) C is the outlet for the release of biogas.
C) B is the chamber which contains leftover slurry.
D) All of these

118.
Dragonflies are used to get rid of:

A) mosquitoes
B) aphids
C) butterfly caterpillars
D) both (a) and (b).

119.
A microbial biocontrol agent that can be used to control butterfly caterpillars is:

A) Trichoderma polysporum
B) Bacillus thuringiensis
C) Streptococcus sp.
D) mycorrhiza.

120.
Fill up the blanks by selecting the correct option (i) Biogas is a mixture of gases which predominantly contains ___ and is used as ___. (ii) Methanogens are commonly found in the ___ during sewage treatment. (iii) ___ species are free-living fungi and effective biocontrol agents of several plant pathogens.

A) (i) methane, fuel, (ii) anaerobic sludge, (iii) Trichoderma
B) (i) CO_2, fuel, (ii) primary sludge, (iii) Trichoderma
C) (i) methane, fuel, (ii) anaerobic sludge, (iii) Baculoviruses
D) (i) methane, fuel, (ii) aerobic sludge, (iii) Trichoderma

121.
Which of the following statements is correct with regard to biocontrol agents?

A) Ladybird and dragonflies are used to get rid of aphids and mosquitoes respectively.
B) Bacillus thuringiensis bacteria are used to control butterfly caterpillars.
C) Trichoderma species are used to control several plant pathogens.
D) All of these

122.
Baculoviruses (Nucleopolyhedrovirus) do not show:

A) host specificity
B) narrow spectrum applications
C) effects on non-target pathogens
D) utility in IPM programme.

123.
Which of the following statements regarding baculoviruses as biocontrol agents is/are correct?

A) The majority of baculoviruses used as biocontrol agents are included in the genus - Nucleopolyhedrovirus.
B) Infection with baculoviruses occurs when susceptible hosts (e.g., some specific insects) eat virus particle present on foliage and dies.
C) These are important in organic farming because of their specific action on harmful insects without causing any damage to beneficial insects as well as to the environment.
D) All of these

124.
Integrated Pest Management (IPM) discourages the excessive use of:

A) biological methods
B) chemical pesticides
C) mechanical methods
D) all of these.

125.
Organic farming includes:

A) use of fertilisers and pesticides of biological origin
B) IPM (Integrated Pest Management)
C) locally developed pest resistant varieties
D) all of these.

126.
Match column I with column II and select the correct option from the given codes.

	Column I		Column II
A.	*Trichoderma*	(i)	Free living nitrogen fixing bacteria
B.	*Streptomyces*	(ii)	Biocontrol agent
C.	*Azospirillum*	(iii)	Free living nitrogen fixing cyanobacteria
D.	*Anabaena*	(iv)	Source of antibiotic

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

127.
Which one of the following can be used as biofertiliser in cotton field?

A) Azolla-Anabaena
B) Streptococcus
C) Azospirillum
D) Azotobacter chroococcum

128.
Which of the following statements is not correct regarding mycorrhiza?

A) It helps in absorption of phosphorus from the soil.
B) It is a symbiotic association of fungi with the roots of higher plants.
C) It helps the plant in developing resistance to root-borne pathogens.
D) None of these

129.
Which one of the following pairs is correctly matched?

A) Rhizobium - Parasite in the roots of leguminous plants
B) Mycorrhizae - Mineral uptake from soil
C) Yeast - Production of biogas
D) Azospirillum - Symbiotic N_2 - fixing bacterium

130.

Study the following statements and select the correct ones. (i) Methanogens are archaebacteria which produce methane in marshy areas. (ii) Nostoc is a filamentous blue green alga which fixes atmospheric nitrogen. (iii) Many members of the genus Glomus form mycorrhiza.

A) (i) and (ii) only **B)** (i) and (iii) only

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

131.

Which of the following is a non-symbiotic biofertiliser?

A) VAM **B)** Azotobacter

C) Anabaena **D)** Rhizobium

132.

Match column I with column II and select the correct option from the given codes.

	Column I		Column II
A.	Ganga action plan	(i)	N_2 fixing cyanobacterium
B.	Bt cotton	(ii)	Ministry of Environment and Forests
C.	*Rhizobium*	(iii)	Insect resistant plant
D.	*Nostoc*	(iv)	N_2 fixing bacterium

A) A-(iv), B-(ii), C-(iii), D-(i) **B)** A-(ii), B-(iii), C-(iv), D-(i)

C) A-(ii), B-(iii), C-(i), D-(iv) **D)** A-(iv), B-(iii), C-(ii), D-(i)

133.

Which of the following is a commercial blood cholesterol lowering agent?

A) Lipases **B)** Cyclosporin A

C) Statin **D)** Streptokinase

134.

Lactic acid bacteria (LAB) grow in milk and convert it to curd and also improve its nutritional quality by increasing:

A) vitamin A **B)** vitamin B_{12}

C) vitamin B_6 **D)** vitamin C and A.

135.

Which of the following is correctly matched for the product produced by them?

A) Methanobacterium : Lactic acid **B)** Penicillium notatum : Acetic acid

C) Saccharomyces cerevisiae : Ethanol **D)** Acetobacter aceti : Antibiotics

Zoology

136.

The structural and functional unit of the vertebrate kidney is

A) Malpighian tubule **B)** renal pyramid

C) uriniferous tubule **D)** renal corpuscle

137.

Match List I with List II.

List I	List II
A) Conditional reabsorption of Na^+ and water	I) DCT
B) Active reabsorption of glucose and amino acids	II) Collecting duct
C) Passive reabsorption of urea	III) Ascending limb of Henle's loo
D) Minimal reabsorption	IV) PCT

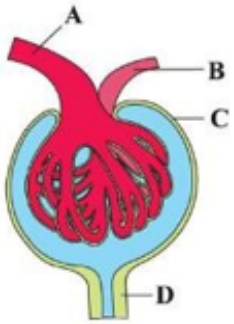
Select the correct option.

A) A-III, B-II, C-IV, D-I **B)** A-I, B-IV, C-II, D-III

C) A-IV, B-I, C-II, D-III **D)** A-I, B-IV, C-III, D-II

138.

Which of the following labelled part in the given diagram is responsible for reabsorption of nearly all of the essential nutrients, and 70-80 per cent of electrolytes and water from the filtrate?



A) A **B)** B

C) C **D)** D

139.

Excretory organ of hemichordates are known as:-

A) Nephridia **B)** Green gland

C) Proboscis gland **D)** organ of Bojanus

140.

Select the correct statement regarding the nephrons in the human kidney.

A) Cortical nephrons are confined to the renal cortex, while juxtamedullary nephrons are confined to the renal medulla.

B) Juxtamedullary nephrons are more numerous than cortical nephrons.

C) Vasa recta are well-developed in cortical nephrons and are either absent or highly reduced in juxtamedullary nephrons.

D) In comparison to cortical nephrons, the urine produced by juxtamedullary nephrons is likely to be more concentrated.

141.
Match List-I with List-I.

List-I	List-II
(A) Balanoglossus	(I) Protonephridia
(B) Balaenoptera	(II) Proboscis gland
(C) Bombyx	(III) Kidneys
(D) Branchiostoma	(IV) Malpighian tubules

Choose the correct answer from the options given below.

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

142.
Which of the following statements regarding the Renin-Angiotensin-Aldosterone System (RAAS) are correct? A. A decrease in glomerular filtration rate (GFR) activates the juxtaglomerular apparatus (JGA) to release renin. B. Renin converts angiotensinogen into angiotensin I, which is further converted into angiotensin II by angiotensin converting enzyme (ACE). C. Angiotensin II causes vasodilation and reduces blood pressure. D. Aldosterone increases sodium and water reabsorption, leading to an increase in blood volume and pressure. E. RAAS activation ultimately results in increased GFR and restoration of blood pressure. Choose the correct answer from the options given below.

A) A, B, D, and E only
B) A, C, D, and E only
C) A, B, C, and E only
D) B, C, D, and E only

143.
Glomerular filtration rate of a healthy person is

A) 1100 mL/min
B) 650 mL/min
C) 125 mL/min
D) 1.5 litres / day

144.
Given below are two statements. Statement I: Osmoreceptors in the body are activated by changes in blood volume, body fluid volume and ionic concentration. Statement II: An excessive loss of fluid from the body can activate osmoreceptors, which stimulate the hypothalamus to release ADH. In light of the above statements, choose the correct answer from the options given below.

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

145.
Given below are two statements : One is labeled as Assertion (A) and the other is labeled as Reason(R): Assertion (A) : Glomerular filtrate is progressively diluted as it passes through the ascending limb of loop of henle. Reason (R) : Ascending limb of loop of Henle is permeable to water and impermeable to salts.

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

146.
All of the following are situated completely in the cortical region of kidneys, except

A) Malpighian corpuscle
B) PCT
C) DCT
D) Loop of Henle

147.
Part of nephron which is impermeable to water allows

A) Reabsorption of fatty acids
B) Secretion of urea
C) Secretion of Ca_2
D) Active transportation of glucose and amino acids

148.
Statement-I: Small amounts of urea enter the thin segment of the ascending limb of Henle's loop which is transported back to the interstitium by the collecting tubule.
Statement-II: The osmolarity of interstitial fluid in kidneys increases towards inner medulla

A) Both Statement I and Statement II are true
B) Statement I is false but Statement II is true
C) Statement I is true but Statement II is false
D) Both Statement I and Statement II are false

149.
Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R: Assertion-(A): Human kidneys have built-in mechanisms for regulation of GFR. Reason-(R): Fall in GFR activates JG cells to release erythropoietin. In the light of the above statements, choose the most appropriate answer from the options given below:

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

150.

Excretion of sodium through urine is promoted by the hormone

A) ANF **B)** ADH

C) Aldosterone **D)** Angiotensin II

151.

Assertion(A): Atrial natriuretic factor decreases the blood pressure. Reason(R): Atrial natriuretic factor can cause dilation of blood vessels.

A) Both A and R are true and R is the correct explanation of A **B)** Both A and R are true and R is not the correct explanation of A

C) A is true but R is false **D)** A is false but R is true

152.

Match the following parts of a nephron with their function:

	List-I		List-II
(1)	Descending limb of Henle's loop	i.	Transport of electrolytes actively or passively
(2)	Proximal Convoluted tubule	ii.	Reabsorption of water only
(3)	Ascending limb of Henle's loop	iii.	Conditional reabsorption of Na^+ and water
(4)	Distal convoluted tubule	iv.	Reabsorption of all the essential nutrients

Select the correct option from the following:

A) (a)-(i), (b)-(iii), (c)-(ii), d-(iv) **B)** (a)-(ii), (b)-(iv), (c)-(i), d-(iii)

C) (a)-(i), (b)-(iv), (c)-(ii), d-(iii) **D)** (a)-(ii), (b)-(i), (c)-(iii), d-(iv)

153.

Assertion: The counter current mechanism in the two limbs of Henley's Loop and the two limbs of vasa recta helps in the formation of concentrated urine. Reason: The counter-current mechanism helps in maintaining a concentration gradient in the medullary interstitium, which helps in easy passage of water from medullary interstitium in to the collecting duct of tubule.-

A) Both Assertion and Reason are True and the Reason is a correct explanation of the Assertion **B)** Both Assertion and Reason are True but Reason is not a correct explanation of the Assertion

C) Assertion is True but the Reason is False **D)** Both Assertion and Reason are False

154.

Statement- I: Functioning of kidneys monitored by hormonal feedback mechanism involving vasopression and renin, both ultimately increase blood volume and blood pressure. Statement- II: Vasoconstrictory effect of Angiostensin -II and vasopressin causes increase glomerular blood flow/ glomerular blood pressure thereby increase GFR.

A) Both Statement I and Statement II are true. **B)** Both Statement I and Statement II are false.

C) Statement I is correct Statement II is false. **D)** Statement I is incorrect but Statement II is true.

155.

The following part of nephron plays a significant role in the maintenance of high osmolarity of medullary interstitial fluid?

A) Malpighian corpuscle **B)** PCT

C) DCT **D)** Loop of henle

156.

Given below are two statements Statement - I :- Malfunctioning of kidneys can lead to accumulation of ammonia in blood, a condition called uremia, which is highly harmful and may lead to kidney failure. Statement - II :- Insoluble mass of crystallised salts formed with in the kidney is called "Glomerulonephritis". .

A) Both Statement I and Statement II are true **B)** Statement I is false but Statement II is true

C) Statement I is true but Statement II is false **D)** Both Statement I and Statement II are false

157.

In the counter current mechanism, small amounts of urea absorbed by the thin segment of the ascending limb of Henle's loop, is transported back to the interstitium by the

A) Descending limb of vasa recta **B)** Collecting duct

C) Ascending limb of vasa recta **D)** DCT

158.

ANF is released when

A) Blood flow to the atria of the heart increases **B)** Blood flow to the atria of the heart decreases

C) Blood flow to the ventricle of the heart increases **D)** Blood flow to the ventricle of the heart decreases

159.

The filtration slits are formed by the cellular arrangement of which of the following cells that are also involved in ultrafiltration?

A) Endothelium of glomerular blood vessels

B) Basement membrane of renal tubule

C) Podocytes of Bowman's capsule

D) Endothelium of afferent arteriole

160.

Match column I with column II

	Column I		Column II
a.	Glycosuria	(i)	Inflammation of glomeruli
b.	Gout	(ii)	Mass of crystallised salts within the kidney.
c.	Renal calculi	(iii)	Presence of glucose in urine
d.	Glomerulo-nephritis	(iv)	Accumulation of uric acid crystals in joints

Choose the correct option

A) a(iv), b(iii), c(ii), d(i)

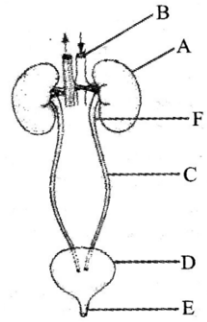
B) a(ii), b(iii), c(i), d(iv)

C) a(iii), b(iv), c(ii), d(i)

D) a(iii), b(ii), c(iv), d(i)

161.

In the diagram of excretory system of human beings given below, different parts have been indicated by alphabets; choose the answer in which these alphabets have been correctly matched with the parts which they represent



A) A = Kidney, B = Abdominal aorta, C = Urethra, D = Urinary bladder, E = Ureters, F = Renal pelvis

B) A = Kidney, B = Ureters, C = Urethra, D = Urinary bladder, E =Abdominal aorta, F = Renal pelvis

C) A = Kidney, B = Renal pelvis, C = Urethra, D = Urinary bladder, E = Ureters, F = Abdominal aorta

D) A = Kidney, B = Abdominal aorta, C = Urethra, D = Urinary bladder, E = Renal pelvis, F = Ureters

162.

Match Column-I with Column-II

Column-I		Column-II	
(A)	Ultrafiltration	A)	Henle's loop
(B)	Concentration of urine	B)	Ureter
(C)	Transport of urine	C)	Urinary bladder
(D)	Storage of urine	D)	Malpighian corpuscles
		(5)	Proximal convoluted tubules

A) A → 4; B → 1; C → 2; D → 3

B) A → 4; B → 3; C → 2; D → 1

C) A → 5; B → 4; C → 1; D → 3

D) A → 5; B → 4; C → 1; D → 2

163.

The principal nitrogenous excretory compound in humans is synthesized

A) in kidneys but eliminated mostly through liver

B) in kidneys as well as eliminated by kidneys

C) in liver and also eliminated by the same through bile

D) in the liver, but eliminated mostly through kidneys

164.

Which one of the following correctly explains the function of a specific part of a human nephron?

A) Podocytes : create minute spaces (slite pores) for the filtration of blood into the Bowman's capsule

B) Henle's loop : most reabsorption of the major substances from the glomerular filtrate

C) Distal convoluted tubule : reabsorption of K+ ions into the surrounding blood capillaries

D) Afferent arteriole : carries the blood away from the glomerular towards renal vein.

165.

A fall in glomerular filtration rate activates

A) adrenal cortex to release aldosterone

B) adrenal medulla to release adrenaline

C) juxta – glomerular cells to release renin

D) posterior pituitary to release vasopressin

166.

Formation of hard crystalized chemical like uric acid , calcium oxalate, calcium phosphate and magnesium ammonium phosphate in kidney is called

A) Renal calculi

B) Glomerulo nephritis

C) Diabetes

D) Uremia

167.

The glomerular capillary blood pressure causes filtration of blood through

A) 2 layers **B)** 1 layers

C) 3 layers **D)** 5 layers

168.

Study the following statements. A) Glucose is a high threshold substance. B) Urine is concentrated in Henle's loop C) Haemodialysis removes urea, uric acid, glucose and water. D) Plasma proteins are filtered out Correct ones of the above are

A) A, C, D **B)** B, C, D

C) A, B **D)** A, C

169.

Match the following regarding excretory system and choose correct one.

	Column – I		Column – II
(A)	Urochrome	A)	Urea forms in liver
(B)	Ornithine cycle	B)	Colour of urine
(C)	Angiotensinogen	C)	Concave border of kidney
(D)	Hilum	D)	Produced by liver

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

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

170.

Match the following regarding excretory system and choose correct one.

	Column – I		Column – II
(A)	Proximal convoluted tubule	A)	Formation of concentrated urine
(B)	Distal convoluted	B)	Filtration blood
(C)	Henle's loop	C)	Reabsorption of 70-80% of electrolytes
(D)	Counter current	D)	Ionic balance mechanism
(E)	Renal corpuscle	(5)	Maintenance of concentration gradient in renal medulla

A) A-3, B-5, C-4, D-2, E-1 **B)** A-3, B-4, C-1, D-5, E-2

C) A-1, B-3, C-2, D-5, E-4 **D)** A-3, B-1, C-4, D-5, E-2

171.

Match the following regarding excretory system and choose correct one.

	Column – I		Column – II
(A)	JG cells	A)	Vasodilator
(B)	Hypothalamus	B)	Vasoconstrictor
(C)	Angiotensis II	C)	Vasopressin
(D)	ANF	D)	Renin

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

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

172.

Read the following and choose the correct combination

Ammonotelic	Ureotelic	Uricotelic
1) Bony fish	Shark fish	Silver fish
2) Shark fish	Bony fish	Cuttelfish
3) Bony fish	Shark fish	starfish
4) Crayfish	Bony fish	flying fish

A) 1 **B)** 2

C) 3 **D)** 4

173.

Justamedullary nephrons are much efficient in reabsorption of components because

A) they are found adjacent area of cortex with medulla **B)** they have larger Bowman's capsules

C) they have long loop of Henle and well developed vasa recta **D)** they are present in desert animals only

174.

Loop of Henle plays a significant role in the maintenance of

A) low osmolarity in medullary interstitial fluid **B)** high osmolarity in cortical interstitial fluid

C) low osmolarity in cortical interstitial fluid **D)** high osmolality in medullary interstitial fluid

175.

Which of the following statement is incorrect pertaining to the functioning of nephron ?

A) Conditional reabsorption of water takes place in proximal convoluted tubule **B)** Concentrated filtrate when passes upward in ascending limb of loop of Henle dilutes due to passage of electrolytes into medullary fluid

C) More glucose is reabsorbed in distal convoluted tubule **D)** There is no hormonal influence on the reabsorption of filtration load in PCT and descending limb

176.

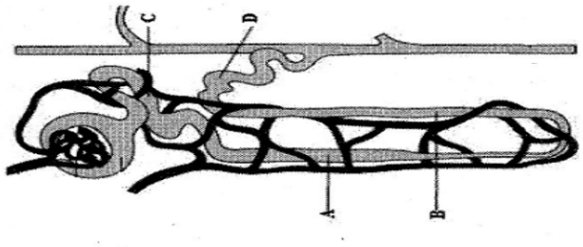
Route of tubular secretion is

A) Blood → Interstitial fluid → Renal fluid **B)** Renal fluid → Interstitial fluid → Blood

C) Blood → Renal fluid → Interstitial fluid **D)** Interstitial fluid → Renal fluid → Blood

177.

Read the following diagram and choose the correct statements. I) In part 'A', the water reabsorption takes place II) In part 'B', the water and electrolytes reabsorption take place III) In part 'C', the water reabsorption takes place IV) In part 'D', the water is reabsorbed but electrolytes are not reabsorbed



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

178.

Read the following

$$\text{Angiotensinogen} \xrightarrow{A} \text{Angiotensin - I} \xrightarrow{B} \text{Angiotensis - II} \longrightarrow \text{Aldosterone}$$

Identify A, B and C.

A) A-Renin, B-Angiotensin converting enzyme and C-Adrenal medulla
B) A-Renin, B-Angiotensin converting enzyme and C-Adrenal cortex
C) A-Angiotensin converting enzyme, B-Renin and C-Adrenal medulla
D) A-Angiotensin converting enzyme, B-Renin and C-Adrenal cortex

179.

Which of the following is the correct pathway for passage of urine in humans ?

A) Collecting tubule → Ureter → Bladder → Urethra
B) Renal vein → Renal ureter → Bladder → Urethra
C) Pelvis Medulla → Bladder → Urethra
D) Cortex → Medulla → Bladder → Ureter

180.

Consider the following statements each with one or two blanks. 1) Towards the centre of the inner concave surface of the kidney is a notch called _____ through which ureters, blood vessels and nerves enter. 2) The medulla of kidney is divided into a few conical masses called _____ projecting into the _____ 3) Glomerulus is a tuft of capillaries formed by the ____ artery. 4) Blood from the glomerulus is carried away by an ____ artery 5) Blood vessel enters into glomerulus is _____ arteriole Which one of the following options correctly fills the blanks in any two of the statements ?

A) 1-renal pelvis, 2 –calyces, 3 –medullary pyramids
B) 2-medullary pyramids, 3-calyces, 4- afferent , 5-efferent
C) 2-columns of Bertini, 3-chordae tendinae, 4-efferent, 5-afferent
D) 1-hilum, 4-efferent, 5-afferent

ANSWER KEY

Physics

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

Chemistry

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

Botany

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

Zoology

136.	**3**	148.	**1**	160.	**3**	172.	**1**
137.	**2**	149.	**3**	161.	**1**	173.	**3**
138.	**4**	150.	**1**	162.	**1**	174.	**4**
139.	**3**	151.	**1**	163.	**4**	175.	**3**
140.	**4**	152.	**2**	164.	**1**	176.	**1**
141.	**2**	153.	**3**	165.	**3**	177.	**2**
142.	**1**	154.	**1**	166.	**1**	178.	**2**
143.	**3**	155.	**4**	167.	**3**	179.	**1**
144.	**1**	156.	**4**	168.	**3**	180.	**4**
145.	**4**	157.	**2**	169.	**4**		
146.	**4**	158.	**1**	170.	**2**		
147.	**2**	159.	**3**	171.	**1**		

SOLUTIONS

Q1.

Answer: A

Explanation:
The terminal voltage V of a battery when it is discharging (supplying current) is given by the formula $V = E - Ir$, where E is the emf, I is the current, and r is the internal resistance.

Q2.

Answer: D

Explanation:
The terminal voltage V is the potential difference across the battery terminals when a current I is flowing through its internal resistance r. It is calculated by subtracting the potential drop across the internal resistance (Ir) from the total electromotive force (E).

Q3.

Answer: B

Explanation:

The square loop is symmetric about diagonal AC. Therefore points B and D are at the same potential, so no current flows through the resistor connected between B and D. The circuit reduces to two equal paths between A and C in parallel.

Q4.

Answer: B

Explanation:

First find the equivalent resistance of the parallel combination. Then add the series resistance to obtain the total resistance. Finally, apply Ohm's law: $I = \frac{V}{R}$

Q5.

Answer: A

Explanation:
When a wire of resistance R is cut into n equal pieces, the resistance of each piece becomes $R' = R/n$. When these n pieces are connected in parallel, the equivalent resistance is $R_{eq} = R'/n = R/n^2$. Here $n = 4$

Q6.

Answer: B

Explanation:
First, calculate the resistance of the two pieces. When connected in parallel, their equivalent resistance is $R'/2$. Finally, add the series resistor of 2 Ω.

Q7.

Answer: B

Explanation:

Since C and D are connected by an ideal wire, they are at the same potential. The left-side resistors are in parallel and the right-side resistors are in parallel. After finding the common node potential, currents in each branch are calculated. Using Kirchhoff's Current Law at the junction gives the current through branch CD.

Q8.

Answer: C

Explanation:
When a wire is stretched, its volume remains constant. If the length increases by a factor of n, the resistance increases by a factor of n^2 because the area of cross-section decreases proportionally. Here, $n = 3$, so the new resistance $R' = n^2R$.

Q9.

Answer: B

Explanation:

First, calculate the new resistance after stretching ($R' = n^2R$). Then, determine the resistance of each half ($R'/2$). Finally, calculate the equivalent resistance for two equal resistors in parallel ($R_{eq} = R_{half}/2$).

Q10.

Answer: C

Explanation:

The current in the circuit is determined using the total resistance, which is the sum of the external resistance and internal resistance. The terminal voltage is the voltage across the external resistor, or equivalently, the emf minus the voltage drop across the internal resistance.

Q11.

Answer: B

Explanation:
The two cells oppose each other, so the effective emf is the difference of their emfs. The total resistance is the sum of all resistors in the loop. Applying Ohm's law gives the current. The direction is that of the stronger cell.

Q12.

Answer: C

Explanation:
In series, the equivalent resistance is 5R, making the current $I_S = E/5R$. In parallel, the equivalent resistance is $R/5$, making the current $I_P = 5E/R$. The factor $n = I_P/I_S = (5E/R)/(E/5R) = 25$.

Q13.

Answer: C

Explanation:

Because the network is infinite, the resistance seen after the first section is the same as the total equivalent resistance. Let the equivalent resistance between the input terminals be R. Forming an equation using self-similarity and solving the resulting quadratic gives the answer.

Q14.

Answer: D

Explanation:
The resistance of each wire is $R = 9\Omega$. When three such resistors are connected in parallel, the equivalent resistance is $R_P = R/3 = 9/3 = 3\Omega$. When connected in series, the equivalent resistance is $R_S = 3 \times R = 3 \times 9 = 27\Omega$. Wait, the question asks for the effective resistance if they are connected in series. $R_S = 9 + 9 + 9 = 27\Omega$.

Q15.

Answer: C

Explanation:
For two resistors in parallel, $R_P = R/2$. Given $R_P = 2\Omega$, we find $R = 4\Omega$. When these two resistors are connected in series, $R_S = R + R = 2R = 2 \times 4 = 8\Omega$.

Q16.

Answer: A

Explanation:

The current I_1 reaches the junction and divides into I_2 and I_3. Using the current division rule, the current in one parallel branch is proportional to the resistance of the opposite branch.

Q17.

Answer: B

Explanation:
Moving from A to B, there is a voltage drop across each resistor equal to IR. There is also a voltage drop of $6\ \mathrm{V}$ across the cell because we move from its positive terminal to its negative terminal. Adding all drops gives $(V_A - V_B)$.

Q18.

Answer: C

Explanation:

Voltmeters Q and R are connected in parallel, so they have the same potential difference across them. Voltmeter P is in series with the parallel combination. Since the equivalent resistance of the parallel part is less than R, a larger voltage appears across P.

Q19.

Answer: C

Explanation:

Move from point A to point B and calculate the change in potential across each element. Across a cell from negative to positive terminal there is a rise in potential. Across a resistor, moving opposite to the current direction gives a rise equal to IR.

Q20.

Answer: C

Explanation:
Kirchhoff's junction law (first law) states that the sum of currents entering a junction equals the sum of currents leaving it. This is based on the principle that charge cannot be created or destroyed at a point in a circuit, which is the law of conservation of charge.

Q21.

Answer: B

Explanation:
Kirchhoff's loop law (second law) states that the algebraic sum of the potential changes around any closed loop is zero. This is a manifestation of the fact that the electric field is conservative, and work done by the field around a closed path is zero, which aligns with the law of conservation of energy.

Q22.

Answer: A

Explanation:

To determine the direction of current through the wire joining A and B, compare the potentials at A and B before connecting the wire. The point with higher potential sends current toward the lower potential point.

Q23.

Answer: C

Explanation:

First find the equivalent resistance of the bridge network. The resistor connecting the top and bottom-right vertices is in parallel with the right-side resistor. Then combine the resulting resistances using series-parallel reduction and apply Ohm's law.

Q24.

Answer: B

Explanation:
When a 16Ω wire is bent into a square, each side has a resistance of $16/4 = 4\Omega$. Connecting opposite corners results in two parallel branches, each containing two sides in series ($4\Omega + 4\Omega = 8\Omega$). The equivalent resistance of two 8Ω resistors in parallel is $8/2 = 4\Omega$.

Q25.

Answer: C

Explanation:
Each piece has a resistance of $R/4$. When four resistors of $R/4$ are connected in parallel, the equivalent resistance is $(R/4)/4 = R/16$.

Q26.

Answer: C

Explanation:

For a balanced meter bridge, $\frac{R_1}{R_2} = \frac{L_1}{L_2}$ where L_1 and L_2 are the lengths of the wire segments on the left and right of the balance point. Using the given resistances, we find the balance length and then determine the distance from the right end.

Q27.

Answer: C

Explanation:
According to the principle of a metre bridge, $\frac{P}{Q} = \frac{l_1}{100-l_1}$. Using this, we find the resistance P. Then, dividing P by its length gives resistance per unit length.

Q28.

Answer: C

Explanation:
The balance condition $\frac{P}{Q} = \frac{l_1}{l_2}$ is independent of the resistance of the bridge wire itself if the resistances X and Y are connected to the gaps directly. We simply use the ratio of the balancing lengths.

Q29.

Answer: C

Explanation:

When a resistance is shunted by an equal resistance, its effective resistance becomes $R' = \frac{R \times R}{R+R} = \frac{R}{2}$ Using the meter bridge balance condition, $\frac{P}{Q} = \frac{l}{100-l}$ we calculate the unknown resistance.

Q30.

Answer: B

Explanation:

Since $\frac{2}{3} = \frac{4}{6}$ the bridge is balanced. Therefore, no current flows through the central $5\ \Omega$ resistor, and it can be ignored. The circuit then becomes two series branches connected in parallel.

Q31.

Answer: B

Explanation:
A standard voltmeter has finite resistance and draws some current from the cell, causing a voltage drop across the internal resistance of the cell, which leads to an inaccurate measurement. The potentiometer uses a null-point method where no current is drawn from the cell, measuring the true e.m.f.

Q32.

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.

Q33.

Answer: A

Explanation:
Since all four arms of the Wheatstone bridge have identical resistance, the bridge is balanced. In a balanced Wheatstone bridge, no current flows through the central galvanometer arm, so it can be removed from the calculation.

Q34.

Answer: A

Explanation:

The left part of the circuit forms a parallel combination between $25, \Omega$ and $(10 + 5) = 15, \Omega$. The right part forms a parallel combination between $20, \Omega$ and $(5 + 5) = 10, \Omega$. These two equivalent resistances are then connected in series between terminals (a) and (b).

Q35.

Answer: C

Explanation:

To find the equivalent resistance between points A and C, we identify the paths connected directly between these two nodes. The circuit consists of a direct path A-C with resistance r and a series path A-E-C with resistance $r + r = 2r$. These two branches are in parallel. The rest of the network (involving B and D) is not part of the circuit between A and C in this configuration. Combining the parallel resistors r and 2r yields $\frac{2r}{3}$.

Q36.

Answer: B

Explanation:

The circuit consists of two parallel branches connected between terminals A and B. Each branch contains a series combination of three resistors of resistance r. The equivalent resistance is calculated using the formula for resistors in parallel.

Q37.

Answer: A

Explanation:

The equivalent resistance of the network is determined by identifying the series and parallel combinations. Due to the symmetry of the connection, the network simplifies to a specific parallel grouping.

Q38.

Answer: C

Explanation:

The equivalent circuit is simplified by identifying bridge-like structures and combining parallel branches. Systematic reduction of the network reveals the total resistance.

Q39.

Answer: C

Explanation:

The total resistance between terminals A and B is found by breaking down the complex arrangement into smaller series and parallel components and solving them sequentially.

Q40.

Answer: C

Explanation:

The network consists of a symmetrical arrangement of 1Ω resistors. Calculating the equivalent resistance involves solving the bridge-like base structure.

Q41.

Answer: B

Explanation:

This circuit is a balanced Wheatstone bridge. Because the ratios of the arm resistances are equal, the central resistor can be ignored, simplifying the calculation of total current.

Q42.

Answer: A

Explanation:

The arrangement forms a standard Wheatstone bridge. When all five resistors are of equal value R, the bridge is balanced, and the equivalent resistance of the entire network is simply R.

Q43.

Answer: A

Explanation:

This network acts as a balanced Wheatstone bridge. The resistance between the points of equal potential (M and N) does not carry current and does not affect the equivalent resistance.

Q44.

Answer: C

Explanation:

The meter bridge is in a balanced state (null deflection). Using the principle of the Wheatstone bridge, the ratio of the unknown resistance to the segment length is equal to the ratio of the known resistance to the remaining segment length.

Q45.

Answer: C

Explanation:

By finding the resistance of the bridge wire segments and using the balancing condition, we solve for X. The total circuit current is then found using the total equivalent resistance and the supply voltage.

Q46.

Answer: D

Explanation:

The relative reactivity of alkyl halides towards S_N2 reactions follows the order
$CH_3 - X > \text{Primary} > \text{Secondary} > \text{Tertiary}.$
Aprotic solvents like DMF increase the reactivity of the nucleophile, favoring the S_N2 pathway. The reaction rate is highest for the least sterically hindered substrate, as bulky groups near the α-carbon obstruct the backside attack of the nucleophile.

Q47.

Answer: A

Explanation:
The S_N1 reaction proceeds in two steps, where the first and slow step involves the formation of a carbocation. The stability of this intermediate determines the reaction rate; benzyl chloride forms a benzylic carbocation ($C_6H_5CH_2^+$) that is highly stabilized by resonance. While other options form less stable primary or secondary carbocations, aryl halides like chlorobenzene are generally unreactive in S_N1 or S_N2 due to the strength of the carbon-halogen bond.

Q48.

Answer: B

Explanation:
During dehydrohalogenation, the reactivity of the alkyl halide is determined by the bond dissociation energy of the carbon-halogen (R—X) bond. As the atomic radius of the halogen increases from fluorine to iodine, the bond dissociation energy decreases. Consequently, theR—I bond is the weakest and breaks most easily, making alkyl iodides the most reactive.

Q49.

Answer: B

Explanation:
An alkyl halide can be converted into an alcohol through a reaction with aqueous sodium hydroxide (NaOH). In this process, the hydroxyl ion (OH^-) acts as a nucleophile and replaces the halide ion (X^-) from the alkyl group. This is a classic example of a nucleophilic substitution reaction.

Q50.

Answer: B

Explanation:
When chlorine gas reacts with propene at a high temperature ($400^{\circ}C$), substitution occurs instead of the typical addition reaction across the double bond. Specifically, allylic substitution takes place, where a hydrogen atom on the methyl group (the allylic position) is replaced by a chlorine atom to form allyl chloride.

Q51.

Answer: B

Explanation:
The reaction of alcohols with hydrogen halides follows a mechanism that involves the formation of a carbocation intermediate. The reaction rate depends on the stability of this carbocation. 2-methylpropan-2-ol is a tertiary (3°) alcohol that forms a stable tertiary carbocation, allowing it to react with HBr at the fastest speed.

Q52.

Answer: C

Explanation:

An S_N1 reaction proceeds through the formation of a stable carbocation intermediate. Allyl chloride (A), tert-butyl chloride (B), and benzyl chloride (D) all form highly stabilized carbocations through resonance or hyperconjugation. However, $C_6H_5CH_2CH_2Cl$(C) forms a primary carbocation that is actually destabilized by the-I effect of the phenyl group, making it unlikely to follow the S_N1 pathway.

Q53.

Answer: D

Explanation:
In halides like chlorobenzene, bromobenzene, and chloroethene, the lone pair of the halogen is delocalized with the ring or alkene π-bonds. This delocalization gives the carbon-halogen bond a partial double bond character, making it very strong and difficult to break. Isopropyl chloride (D) does not have this restriction and can easily generate a carbocation electrophile for the reaction.

Q54.

Answer: B

Explanation:

Stability of carbocations generally follows the order $3^{\circ} > 2^{\circ} > 1^{\circ} > \text{methyl}$. While t-butyl chloride forms a very stable 3° carbocation with nine hyperconjugative structures, benzyl chloride forms a carbocation that is stabilized by extensive resonance delocalization throughout the benzene ring. When comparing resonance to hyperconjugation (no-bond resonance), resonance is generally the preferred stabilizing effect, making the benzyl carbocation more stable.

Q55.

Answer: C

Explanation:

The methyl group ($-CH_3$) is an ortho/para-directing group. In m-Xylene (1,3-dimethylbenzene), both methyl groups direct the incoming electrophile to positions 2, 4, and 6. However, position 2 is located between the two methyl groups and is highly sterically hindered, making substitution there nearly impossible. Therefore, substitution occurs predominantly at the less crowded 4 and 6 positions.

Q56.

Answer: D

Explanation:
The nitro group ($-NO_2$) is a powerful electron-withdrawing group that deactivates the benzene ring. Because of its electron-withdrawing nature, it creates a partial positive charge at theortho and para positions relative to itself. This makes the carbon atom attached to the chlorine more susceptible to nucleophilic attack, allowing for much easier removal of the chlorine atom.

Q57.

Answer: D

Explanation:
In a chiral substrate, the S_N1 mechanism proceeds via a planar carbocation intermediate, allowing the nucleophile to attack from either side, which leads to racemisation. The S_N2 mechanism involves a concerted backside attack, resulting in a complete inversion of configuration (Walden inversion).

Q58.

Answer: D

Q59.

Answer: D

Q60.

Answer: D

Explanation:

Reactivity in electrophilic aromatic substitution depends on the electron density of the benzene ring. Toluene (B) is the most reactive due to the activating $+I$ and hyperconjugative effect of the methyl group. Chlorobenzene (C) is less reactive than benzene because chlorine is deactivating ($-I$ effect), and Nitrobenzene (D) is the least reactive due to the strongly deactivating $-NO_2$ group.

Q61.

Answer: A

Q62.

Answer: C

Q63.

Answer: A

Explanation:

Nucleophilic aromatic substitution (S_NAr) is greatly accelerated by the presence of electron-withdrawing groups (EWG) like$-NO_2$at the ortho and para positions. These groups stabilize the intermediate carbanion through resonance (-M effect). The more nitro groups present, the more reactive the halide.

Q64.

Answer: C

Q65.

Answer: D

Explanation:

All four statements describe fundamental principles of organic reactivity. S_N2 is hindered by bulky groups, S_N1 depends on the stability of the intermediate cation, electron-withdrawing groups (EWG) deactivate rings toward electrophiles, and EWGs activate rings toward nucleophiles.

Q66.

Answer: D

Q67.

Answer: C

Explanation:

In Friedel-Crafts alkylation with $n-propyl$ chloride, a primary carbocation ($CH_3CH_2CH_2^+$) is initially formed. However, this cation is unstable and quickly undergoes a $1,2-hydride$ shift to produce the significantly more stable secondary isopropyl carbocation ($CH_3-CH^+-CH_3$).

Q68.

Answer: D

Explanation:

In vinyl chloride ($CH_2=CH-Cl$), the lone pair of electrons on the chlorine atom is in conjugation with theπ-bond of the double bond. This resonance ($CH_2=CH-\ddot{C}l:\leftrightarrow^-CH_2-CH=\ddot{C}l^+$) gives the carbon-chlorine bond partial double bond character, making it shorter and stronger than a typical single bond.

Q69.

Answer: C

Explanation:
S_N1 reactions are independent of nucleophile strength (1) and are accelerated by bulky groups (2) which relieve steric strain upon ionization. The planar intermediate leads to racemization (3). However, the reaction requires polar protic solvents to stabilize the ions, making observation (4) incorrect.

Q70.

Answer: D

Explanation:

Retention of configuration occurs if the reaction does not take place at the chiral center. In $1-bromo-2-methylbutane$ (D), the nucleophile attacks the primary carbon bearing the bromine (CH_2Br). Since the bonds connected to the chiral center (C2) are not broken or formed, its configuration remains unchanged.

Q71.

Answer: B

Explanation:

Reactivity in nucleophilic aromatic substitution is increased by electron-withdrawing groups at the ortho and para positions. (II) has nitro groups at o,m; (III) has them at o,p; and (IV) has them atm,m. Activated aromatics generally react faster than the standard aliphatic S_N2 seen in benzyl chloride (I) when using strong nucleophiles.

Q72.

Answer: B

Explanation:
Bromination in light proceeds via a free-radical mechanism. The ease of hydrogen replacement depends on the stability of the resulting radical. Abstraction of a γ-hydrogen produces an allyl free radical ($CH_3-CH^\bullet-CH=CH_2$), which is highly stable due to resonance with the adjacent double bond.

Q73.

Answer: D

Explanation:
Assertion (A) is correct; vinyl halides are inert. However, Reason (R) is false. The vinylic carbocation ($CH_2=CH^+$) is extremely unstable because the positive charge is on an sp orbital of an sp^2 carbon, and there is no resonance stabilization from the π-electrons. The lack of reactivity is actually due to the partial double bond character of the $C-X$ bond.

Q74.

Answer: B

Explanation:

The S_N1 rate is determined by the stability of the benzylic carbocation intermediate. p-Methoxy (D) is most stable due to the $+R$ effect. p-Methyl (C) is stabilized by the $+H$ effect. m-Methoxy (B) is the least stable because, from the meta position, it can only exert an electron-withdrawing $-I$ effect, destabilizing the cation.

Q75.

Answer: A

Explanation:

An S_N1 reaction is a two-step process. The first step (formation of the carbocation) is the slow, rate-determining step and has a higher activation energy. This produces a potential energy diagram with two peaks (transition states) and a central well representing the relatively stable carbocation intermediate.

Q76.

Answer: A

Q77.

Answer: B

Explanation:
Alkyl fluorides are best prepared by the Swarts reaction, which involves heating alkyl chlorides or bromides with metallic fluorides such as AgF, Hg_2F_2, CoF_2, or SbF_3. Direct fluorination is too violent to be controlled in the laboratory.

Q78.

Answer: B

Explanation:
The rate of an S_N2 reaction is determined by steric hindrance at the reaction center. As the number of alkyl groups attached to the α-carbon increases, the transition state becomes more crowded and higher in energy. Thus, the reactivity order is: Methyl > Primary > Secondary > Tertiary.

Q79.

Answer: A

Explanation:

Bond length is directly proportional to the atomic radius of the atoms involved. As you move down Group 17 from Fluorine to Iodine, the size of the halogen atom increases significantly. Therefore, the distance between the carbon nucleus and the halogen nucleus (bond length) also increases in the order $F < Cl < Br < I$.

Q80.

Answer: B

Q81.

Answer: A

Q82.

Answer: D

Explanation:
Monochlorination of $2-methylbutane$ yields four constitutional isomers. (1) $1-chloro-2-methylbutane$ is chiral (exists as 2 enantiomers). (2) $2-chloro-2-methylbutane$ is achiral (1 isomer). (3) $2-chloro-3-methylbutane$ is chiral (exists as 2 enantiomers). (4) $1-chloro-3-methylbutane$ is achiral (1 isomer). The total number of stereoisomers is 6.

Q83.

Answer: B

Q84.

Answer: A

Explanation:

The rate of S_N1 reactivity is directly proportional to the stability of the carbocation formed. (B) forms a secondary allylic carbocation ($CH_2=CH-CH^+-CH_3$), which is resonance-stabilized. (C) forms a simple secondary carbocation. (A) forms a primary carbocation. Stability order: Resonance-stabilized 2° > 2° > 1°.

Q85.

Answer: D

Explanation:
S_N2 reactions proceed with 100% inversion of configuration. The reaction is most favored by compounds with the least steric hindrance. Methyl chloride (CH_3Cl) has no bulky alkyl groups to block the incoming nucleophile, allowing for the easiest and fastest S_N2 displacement with complete inversion.

Q86.

Answer: C

Explanation:
The S_N2 mechanism involves a pentavalent transition state. Large, bulky alkyl groups attached to the reacting carbon atom create steric hindrance, which significantly raises the energy of this transition state and slows the reaction. Therefore, the reactivity decreases as the carbon becomes more substituted: Primary (RCH_2X) > Secondary (R_2CHX) > Tertiary (R_3CX).

Q87.

Answer: B

Explanation:

This is a nucleophilic substitution reaction. The cyanide ion (CN^-) is a good nucleophile, and DMF is a polar aprotic solvent favoring S_N2. The reaction occurs at the benzylic position where the chlorine is located. The iodine atom on the aromatic ring is inert to nucleophilic substitution under these conditions due to resonance effects.

Q88.

Answer: A

Explanation:
In the S_N2 mechanism, the nucleophile must attack the carbon atom from the side opposite to the leaving group. In a tertiary alkyl halide, the carbon atom is surrounded by three large alkyl groups that physically block the path of the incoming nucleophile. This steric hindrance makes the transition state extremely difficult to reach.

Q89.

Answer: A

Q90.

Answer: C

Q91.

Answer: B

Q92.

Answer: C

Q93.

Answer: C

Q94.

Answer: C

Q95.

Answer: A

Q96.

Answer: C

Q97.

Answer: A

Q98.

Answer: A

Q99.

Answer: D

Q100.

Answer: B

Q101.

Answer: A

Q102.

Answer: D

Q103.

Answer: C

Q104.

Answer: C

Q105.

Answer: B

Q106.

Answer: A

Q107.

Answer: A

Q108.

Answer: C

Q109.

Answer: D

Q110.

Answer: A

Q111.

Answer: A

Q112.

Answer: D

Q113.

Answer: B

Q114.

Answer: D

Q115.

Answer: C

Q116.

Answer: A

Q117.

Answer: A

Q118.

Answer: A

Q119.

Answer: B

Q120.

Answer: A

Q121.

Answer: D

Q122.

Answer: C

Q123.

Answer: D

Q124.
Answer: B

Q125.
Answer: D

Q126.
Answer: B

Q127.
Answer: D

Q128.
Answer: D

Q129.
Answer: B

Q130.
Answer: D

Q131.
Answer: B

Q132.
Answer: A

Q133.
Answer: C

Q134.
Answer: B

Q135.
Answer: C

Q136.
Answer: C

Q137.
Answer: B

Q138.
Answer: D

Q139.
Answer: C

Q140.
Answer: D

Q141.
Answer: B

Q142.
Answer: A

Q143.
Answer: C

Q144.
Answer: A

Q145.
Answer: D

Q146.
Answer: D

Q147.
Answer: B

Q148.
Answer: A

Q149.
Answer: C

Q150.
Answer: A

Q151.
Answer: A

Q152.
Answer: B

Q153.
Answer: C

Q154.
Answer: A

Q155.
Answer: D

Q156.
Answer: D

Q157.
Answer: B

Q158.
Answer: A

Q159.
Answer: C

Q160.
Answer: C

Q161.
Answer: A

Q162.
Answer: A

Q163.
Answer: D

Q164.
Answer: A

Q165.
Answer: C

Q166.
Answer: A

Q167.
Answer: C

Q168.
Answer: C

Q169.
Answer: D

Q170.
Answer: B

Q171.
Answer: A

Q172.
Answer: A

Q173.
Answer: C

Q174.
Answer: D

Q175.
Answer: C

Q176.
Answer: A

Q177.
Answer: B

Q178.
Answer: B

Q179.
Answer: A

Q180.
Answer: D