

Physics

- A metallic spherical shell of radius R is given a charge Q . Which of the following statements is correct regarding the electrostatic properties of this conductor in a static situation? A. The electric field is maximum at the center of the shell. B. The electric potential is zero at every point inside the shell. C. The electric field is zero at every point inside the shell. D. The electric potential on the surface is $V = \frac{Q}{4\pi\epsilon_0 R^2}$.
A) A only B) C only
C) B and D only D) A and C only
- An electric dipole with dipole moment $P = 4 \times 10^{-6} \text{ C m}$ is initially aligned anti-parallel to a uniform electric field of magnitude $E = 3 \times 10^5 \text{ N/C}$. Calculate the change in potential energy when it is rotated by 180° .
A) -2.4 J B) 2.4 J
C) -1.2 J D) 1.2 J
- An electric dipole of dipole moment $P = 6 \times 10^{-6} \text{ C m}$ is placed in a uniform electric field of magnitude $E = 2 \times 10^5 \text{ N/C}$. The dipole is initially oriented at an angle of 60° with the electric field. Calculate the work done by an external agent to rotate the dipole until it is aligned at an angle of 120° with the electric field.
A) 0.6 J B) 1.2 J
C) -0.6 J D) 0 J
- Two identical small conducting spheres, each carrying a charge q , are separated by a distance d and experience an electrostatic force F . A third identical uncharged conducting sphere is first touched to the first sphere, then to the second sphere, and finally removed. What is the new force of repulsion between the two spheres?
A) $3F/4$ B) $3F/8$
C) $F/2$ D) $3F/16$
- Two identical small conducting spheres A and B are separated by a distance d and experience an electrostatic force of repulsion F . A third identical uncharged conducting sphere C is brought in contact with sphere A, then brought in contact with sphere B, and finally removed. If sphere C is now placed at the midpoint of the line joining A and B, what is the net electrostatic force on sphere C?
A) 0 B) $F/8$
C) $3F/16$ D) $9F/16$
- A solid metallic sphere of radius $R = 5 \text{ cm}$ is charged with $3.14 \mu\text{C}$. The surface charge density on the sphere is approximately:
A) $1 \times 10^{-4} \text{ C m}^{-2}$ B) $2 \times 10^{-4} \text{ C m}^{-2}$
C) $0.5 \times 10^{-4} \text{ C m}^{-2}$ D) $4 \times 10^{-4} \text{ C m}^{-2}$
- A solid metal sphere of radius 10 cm is charged with $12 \mu\text{C}$. The surface charge density on the sphere is:
A) $0.095 \times 10^{-3} \text{ C m}^{-2}$ B) $0.048 \times 10^{-3} \text{ C m}^{-2}$
C) $0.125 \times 10^{-3} \text{ C m}^{-2}$ D) $0.250 \times 10^{-3} \text{ C m}^{-2}$
- The electric potential at a distance of 10 cm from a point charge of $5 \times 10^{-7} \text{ C}$ is (Given $\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ Nm}^2 \text{ C}^{-2}$):
A) $4.5 \times 10^4 \text{ V}$ B) $9.0 \times 10^4 \text{ V}$
C) $4.5 \times 10^3 \text{ V}$ D) $2.25 \times 10^4 \text{ V}$
- Calculate the electric potential at a point 0.5 m away from a charge of $2 \times 10^{-8} \text{ C}$ (Given $\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ Nm}^2 \text{ C}^{-2}$):
A) 360 V B) 720 V
C) 180 V D) 90 V
- A point charge q is placed at the center of a spherical shell of radius R . The electric flux passing through the entire spherical shell is:
A) $\frac{q}{\epsilon_0}$ B) $\frac{q}{2\epsilon_0}$
C) $\frac{q}{4\pi\epsilon_0 R^2}$ D) Zero
- A dipole is enclosed by a closed surface. What is the net electric flux coming out of the surface?
A) $\frac{2p}{\epsilon_0}$ B) $\frac{p}{\epsilon_0}$
C) Zero D) $\frac{p}{2\epsilon_0}$

12. A point charge of $2\mu C$ is placed at the center of a spherical Gaussian surface of radius R . If the radius of the sphere is doubled to $2R$, the electric flux passing through the surface will:

- A) Remain the same B) Become double
C) Become four times D) Become half

13. A charge $q = 8.85 \times 10^{-10} C$ is placed at the center of a cube of side $10cm$. The electric flux passing through any one face of the cube is (Given $\epsilon_0 = 8.85 \times 10^{-12} C^2 N^{-1} m^{-2}$):

- A) $10Nm^2C^{-1}$ B) $100Nm^2C^{-1}$
C) $16.6Nm^2C^{-1}$ D) $60Nm^2C^{-1}$

14. A thin conducting spherical shell of radius R has a total charge q . What is the electric field at a distance $r = 3R$ from the center of the shell?

- A) $kq/9R^2$ B) $kq/3R^2$
C) kq/R^2 D) $kq/27R^2$

15. A conducting sphere of radius R is charged such that the potential at its surface is V . What is the magnitude of the electric field at a distance $r = 2R$ from the center of the sphere?

- A) $V/2R$ B) $V/4R$
C) V/R D) $V/8R$

16. An electric dipole with a dipole moment of $3 \times 10^{-6} Cm$ is placed in a uniform electric field of $4 \times 10^5 NC^{-1}$. If the dipole experiences a maximum torque of $1.2Nm$, what is the angle it makes with the electric field?

- A) 90° B) 60°
C) 30° D) 0°

17. A point charge q is located at the center of a spherical shell of radius R . The net electric flux Φ through the entire spherical shell is given as Φ_0 . If the charge is moved to a position at distance $R/2$ from the center but still inside the shell, what will be the new net electric flux Φ' through the shell?

- A) Φ_0 B) $2\Phi_0$
C) $\Phi_0/2$ D) 0

18. Two hollow conducting spheres of radii r and $3r$ have equal charges q on them. If the spheres are connected by a thin conducting wire, what is the ratio of the potential of the larger sphere to the potential of the smaller sphere before they were connected?

- A) 9 : 1 B) 3 : 1
C) 1 : 1 D) 1 : 3

19. Two point charges $+q$ and $-q$ are separated by a small distance l . The magnitude of the electric field at an equatorial point at a distance r ($r \gg l$) from the center of the dipole varies as:

- A) $1/r$ B) $1/r^2$
C) $1/r^3$ D) $1/r^4$

20. Which of the following statements best describes non-polar molecules?

- A) Molecules having a permanent electric dipole moment. B) Molecules in which the centres of positive and negative charges coincide, resulting in zero permanent dipole moment.
C) Molecules that always possess a net dipole moment regardless of the external electric field. D) Molecules that have a dipole moment only due to permanent magnetic properties.

21. Two charged spherical conductors of radius R_1 and R_2 are connected by a conducting wire. If the surface charge density on the spheres is σ_1 and σ_2 respectively, what is the ratio of the potential of the spheres V_1/V_2 ?

- A) R_1/R_2 B) R_2/R_1
C) 1 D) $(R_1/R_2)^2$

22. Eight drops of water, each of radius r and having a charge q , combine to form a bigger drop. Find the ratio of the potential of the bigger drop to that of a smaller drop.

- A) 4 : 1 B) 1 : 4
C) 8 : 1 D) 1 : 8

23. A large drop of oil of radius 1 cm is charged to a potential of 100 V. It breaks into 1000 identical small droplets. What is the potential of each small droplet?

- A) 10 V B) 100 V
C) 1000 V D) 1 V

24. A short electric dipole has a dipole moment of $8 \times 10^{-9} Cm$. Find the electric potential at a distance of 0.4 m from the centre of the dipole on the axial line.

- A) 450 V B) 900 V
C) 225 V D) 1800 V

25. An electric dipole of dipole moment $p = 4 \times 10^{-9} Cm$ is placed in an electric field. Calculate the electric potential due to this dipole at a point at a distance of 0.2 m from the centre of the dipole, situated on a line making an angle of 60° with the dipole axis. (Given $\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 Nm^2/C^2$)

- A) 200 V B) 900 V
C) 1800 V D) 450 V

26. A thin spherical shell of radius 20 cm has a charge of $4.0 \times 10^{-8} \text{ C}$ distributed uniformly on its surface. What is the magnitude of the electric field at a point 10 cm from the centre of the sphere?

- A) $3.6 \times 10^3 \text{ N/C}$ B) $1.8 \times 10^4 \text{ N/C}$
C) Zero D) $9.0 \times 10^3 \text{ N/C}$

27. A spherical conductor of radius 20 cm has a charge of $6.4 \times 10^{-7} \text{ C}$ distributed uniformly. What is the magnitude of the electric field at a point 30 cm from the centre of the sphere?
($\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ Nm}^2/\text{C}^2$)

- A) $0.64 \times 10^5 \text{ N/C}$ B) $6.4 \times 10^4 \text{ N/C}$
C) $0.64 \times 10^6 \text{ N/C}$ D) $6.4 \times 10^5 \text{ N/C}$

28. A solid conducting sphere of radius R is given a charge Q . What is the electric field at a distance r from the centre for the case where $r < R$?

- A) $\frac{1}{4\pi\epsilon_0} \frac{Q}{R^2}$ B) $\frac{1}{4\pi\epsilon_0} \frac{Q}{r^2}$
C) Zero D) $\frac{1}{4\pi\epsilon_0} \frac{Qr}{R^3}$

29. An electric dipole of length 4 cm, when placed with its axis making an angle of 60 degrees with a uniform electric field of 10^5 N/C , experiences a torque of $8\sqrt{3} \text{ Nm}$. Calculate the magnitude of the charge on the dipole.

- A) 8 mC B) 4 mC
C) 2 mC D) 7 mC

30. The electric field in a region is given by $E = Ar^2$, where A is a constant and r is the radial distance. Find the total charge contained within a sphere of radius R centered at the origin.

- A) $4\pi\epsilon_0 AR^4$ B) $2\pi\epsilon_0 AR^4$
C) $4\pi\epsilon_0 AR^3$ D) $8\pi\epsilon_0 AR^4$

31. A non-conducting solid sphere of radius R is uniformly charged with a total charge Q . What is the electric potential at the centre of the sphere?

- A) $\frac{1}{4\pi\epsilon_0} \frac{Q}{R}$ B) $\frac{3}{2} \frac{1}{4\pi\epsilon_0} \frac{Q}{R}$
C) $\frac{1}{2} \frac{1}{4\pi\epsilon_0} \frac{Q}{R}$ D) Zero

32. An electric dipole of dipole moment p is placed in a uniform electric field E such that it makes an angle of 60 degrees with the field. What is the amount of work done to rotate the dipole until it is aligned perpendicular to the electric field?

- A) $\frac{1}{2} pE$ B) pE
C) $2pE$ D) $\frac{\sqrt{3}}{2} pE$

33. A point charge q is placed at the center of one of the faces of a cube of side a . What is the electric flux passing through the entire cube?

- A) $q\epsilon_0$ B) $q/2\epsilon_0$
C) $q/4\epsilon_0$ D) $q/8\epsilon_0$

34. An electric dipole of moment p is placed in an electric field of intensity E . The dipole is rotated from a position where its axis makes an angle $\theta_1 = 0^\circ$ with the field direction to a position where it makes an angle $\theta_2 = 60^\circ$ with the field direction. Find the work done by the external agent in rotating the dipole.

- A) $pE/2$ B) pE
C) $2pE$ D) $pE/4$

35. A point charge q is located at the center of a cubical Gaussian surface of side length a . If the side length of the cube is doubled to $2a$ while the charge q remains at the center, the total electric flux passing through the cube will

- A) increase four times B) be reduced to half
C) remain the same D) be doubled

36. The electric field at a distance $r/2$ from the center of a charged solid non-conducting sphere of radius r carrying a total charge Q distributed uniformly throughout its volume is E' . What is the value of E' in terms of the electric field E on the surface of the sphere?

- A) $E/2$ B) $2E$
C) $E/4$ D) zero

37. Three concentric spherical shells have radii a , $2a$ and $3a$ and have surface charge densities σ , $-\sigma$ and σ respectively. If V_A , V_B and V_C denote the potentials of the three shells, then the relationship between them is

- A) $V_A = V_C \neq V_B$ B) $V_A \neq V_B \neq V_C$
C) $V_A = V_B = V_C$ D) $V_A = V_B \neq V_C$

38. Three point charges $+q$, $+2q$ and $-3q$ are placed at the vertices of an equilateral triangle of side length a as shown in the xy -plane: $+q$ at $(0, 0)$, $+2q$ at $(a, 0)$, and $-3q$ at $(a/2, a\frac{\sqrt{3}}{2})$. The electric dipole moment of this system of charges is:

- A) $qa\hat{i} - qa\sqrt{3}\hat{j}$ B) $-qa\hat{i} + qa\sqrt{3}\hat{j}$
C) $qa\hat{i} + qa\sqrt{3}\hat{j}$ D) $-qa\hat{i} - qa\sqrt{3}\hat{j}$

39. An electric dipole of dipole moment p is initially placed in a uniform electric field E such that it makes an angle of 60° with the field direction. What is the work done in rotating the dipole to the stable equilibrium position?

- A) $pE/2$ B) pE
C) $2pE$ D) $pE/\sqrt{2}$

40. An electric dipole of charge magnitude q and separation $2a$ is placed in a uniform electric field E . If the dipole moment is oriented at an angle of 90° degrees with respect to the electric field direction, what are the net force on it and the torque acting on it respectively?

- A) qE and pE B) Zero and pE
C) Zero and zero D) $2qE$ and $pE/2$

41. A point charge q is placed at a corner of a cube. The electric flux passing through the entire cube is

- A) $q/(8\epsilon_0)$ B) $q/(4\epsilon_0)$
C) $q/(2\epsilon_0)$ D) q/ϵ_0

42. A solid conducting sphere of radius R is given a charge Q . What is the electric potential at a distance r from the center of the sphere, where $r < R$?

- A) $Q/(4\pi\epsilon_0 r)$ B) $Q/(4\pi\epsilon_0 R)$
C) 0 D) $Q/(4\pi\epsilon_0 R^2)$

43. A point charge q is placed at the center of a cube of side length a . What is the electric flux passing through one of the faces of the cube?

- A) $q/(6\epsilon_0)$ B) $q/(3\epsilon_0)$
C) $q/(2\epsilon_0)$ D) q/ϵ_0

44. An electric dipole of dipole moment p is placed in a uniform electric field E . If the dipole is aligned parallel to the field, what is the torque acting on it?

- A) pE B) $pE \sin(\theta)$
C) 0 D) $pE \cos(\theta)$

45. A point charge q is placed at the center of one of the faces of a cube. What is the electric flux passing through the entire cube?

- A) q/ϵ_0 B) $q/(2\epsilon_0)$
C) $q/(4\epsilon_0)$ D) $q/(6\epsilon_0)$

Chemistry

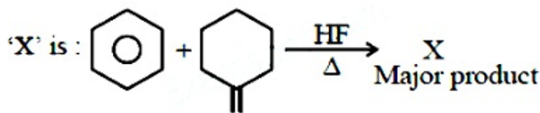
46. Among the following, the total number of meta-directing functional groups is: (Integer based)

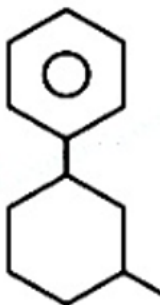
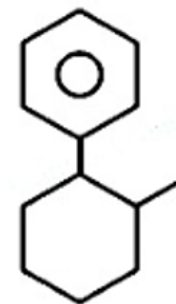
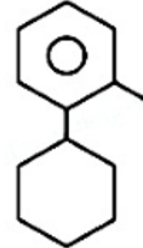
$-OCH_3$, $-NO_2$, $-CN$, $-CH_3$, $-NHCOCH_3$, $-COR$, $-OH$, $-COOH$, $-Cl$

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

47. Number of isomeric products formed by monochlorination of 2-methylbutane in presence of sunlight is:

- A) 4 B) 5
C) 6 D) 7

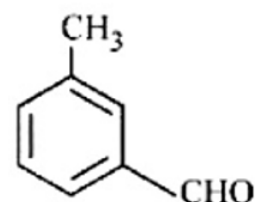
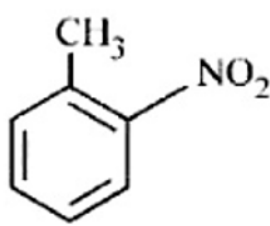
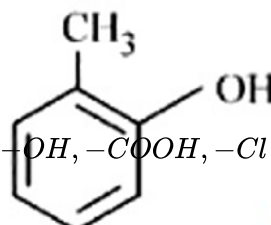
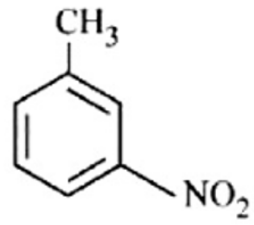
48. 'X' is:  Major product

- A)  B) 
C)  D) 

49. Number of bromo derivatives obtained on treating ethane with excess of Br_2 , in diffused sunlight is:

- A) 6 B) 8
C) 9 D) 10

50. Halogenation of which one of the following will yield an m-substituted product with respect to the methyl group as a major product?

- A)  B) 
C)  D) 

51. In Friedel-Crafts alkylation of aniline, one gets:

- A) alkylated product with ortho and para substitution B) secondary amine after acidic treatment
C) an amide product D) positively charged nitrogen at benzene ring

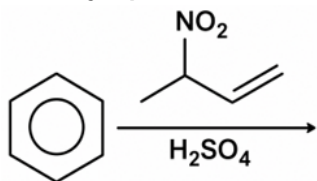
52. Total number of isomers (including stereoisomers) obtained on monochlorination of methylcyclohexane is:

- A) 8 B) 10
C) 12 D) 14

53. Arrange the following in increasing order of reactivity towards nitration: A. p-xylene B. bromobenzene C. mesitylene D. nitrobenzene E. benzene Choose the correct answer from the options given below

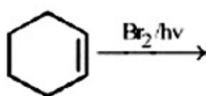
- A) $D < B < C < A < E$ B) $D < B < E < A < C$
C) $C < D < B < A < E$ D) $E < A < C < B < D$

54. The major product of the following reaction is:



- A) B)
C) D)

55. Bromination of cyclohexene under conditions of



sunlight yields:

- A) B)
C) D)

56. The product of the reaction between ethyl benzene and N-bromosuccinimide (NBS) is:

- A) B)
C) D)

57. The reaction of toluene with Cl_2 in presence of $FeCl_3$ gives predominantly:

- A) m-chlorotoluene B) benzyl chloride
C) benzoyl chloride D) o- and p-chlorotoluene

58. The major product obtained in the photo catalysed bromination of 2 methylbutane is:

- A) 1-bromo-2-methylbutane B) 1-bromo-3-methylbutane
C) 2-bromo-3-methylbutane D) 2-bromo-2-methylbutane

59. Of the five isomeric hexanes, the isomer which can give two monochlorinated compounds is:

- A) 2-methylpentane B) 2,2-dimethylbutane
C) 2,3-dimethylbutane D) n-hexane

60. On mixing a certain alkane with chlorine and irradiating it with ultraviolet light, it forms only one monochloroalkane. This alkane could be

- A) pentane B) isopentane
C) neopentane D) propane

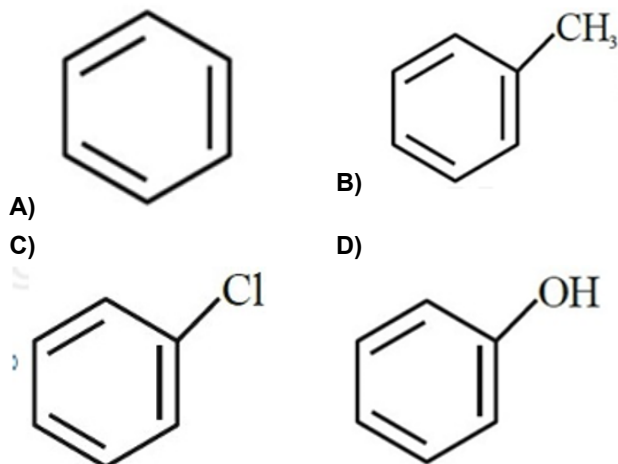
61. The arenium ion which is not involved in the bromination of Aniline is

- A) B)
C) D)

62. Given below are two statements: Statement (I) : The NH_2 group in Aniline is ortho and para directing and a powerful activating group. Statement (II) : Aniline does not undergo FriedelCraft's reaction (alkylation and acylation). In the light of the above statements, choose the most appropriate 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 incorrect but Statement II is correct
 D) Statement I is correct but Statement II is incorrect

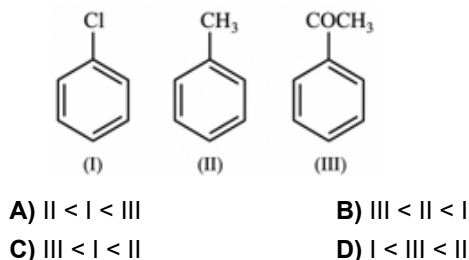
63. Which of the following compound will most easily be attacked by an electrophile?



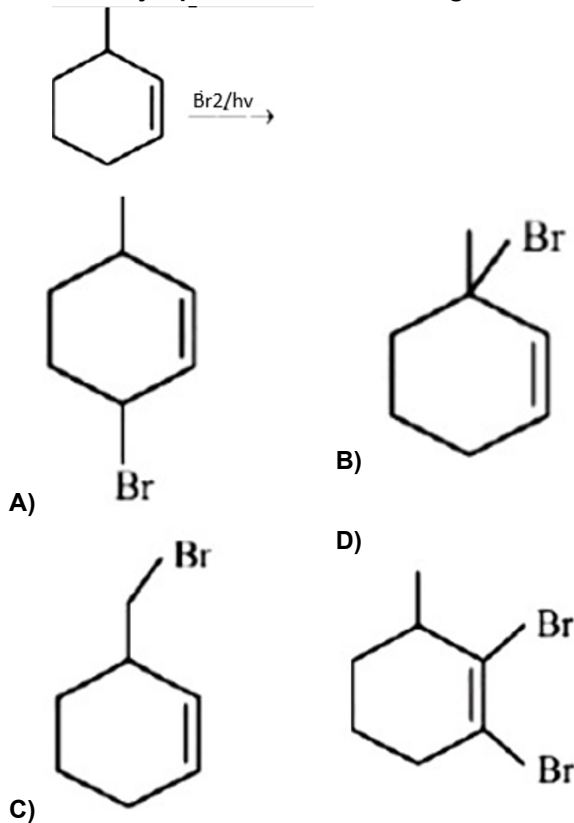
64. Benzene on nitration gives nitrobenzene in presence of HNO_3 and H_2SO_4 mixture, where

- A) both H_2SO_4 and HNO_3 act as a bases
 B) HNO_3 acts as an acid and H_2SO_4 acts as a base
 C) both HNO_3 and HNO_3 act as an acids
 D) HNO_3 acts as a base and H_2SO_4 acts as an acid

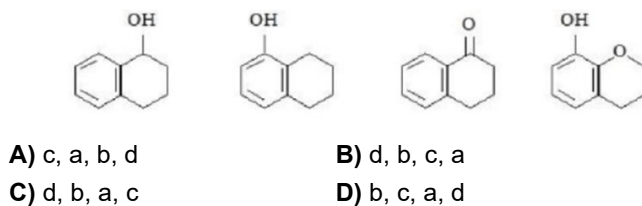
65. The increasing order of the reactivity of the following compounds towards electrophilic aromatic substitution reactions is :



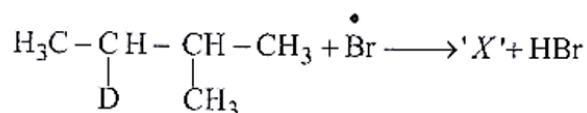
66. The major product of the following reaction is:



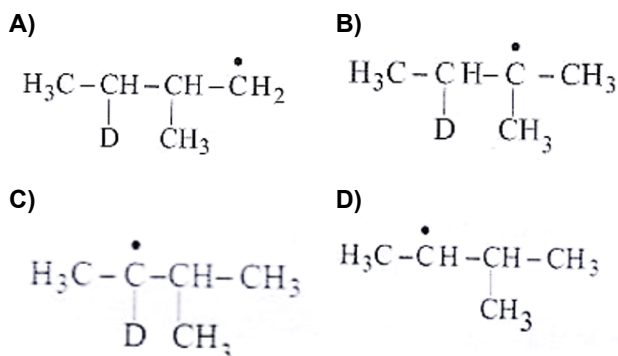
67. Arrange the following compounds in increasing order of rate of aromatic electrophilic substitution reaction



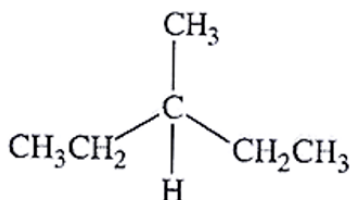
68. Consider the following reaction:



Identify the structure of the major product 'X'.



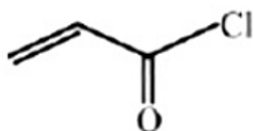
69. The maximum number of isomers (including stereoisomers) that are possible on monochlorination of the following compound is:



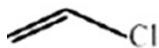
- A) 4
B) 6
C) 8
D) 10

70. Which of the following compounds will not undergo Friedel Craft's reaction with benzene?

A)



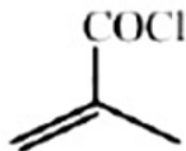
B)



C)



D)



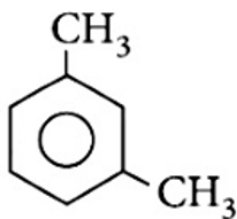
71. The alkane that gives only one monochloro product on chlorination with Cl_2 in presence of diffused sunlight is:

- A) 2,2-dimethylbutane
B) neopentane
C) n-pentane
D) isopentane

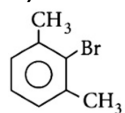
72. Which of the following can be used as the halide component for Friedel-Crafts reaction?

- A) Chlorobenzene
B) Bromobenzene
C) Chloroethene
D) Isopropyl chloride

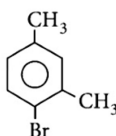
73. What products are formed when m-Xylene is treated with Br_2 in the presence of $FeBr_3$?



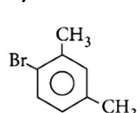
A)



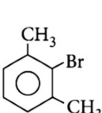
and



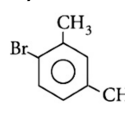
B)



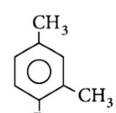
and



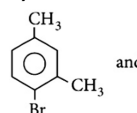
C)



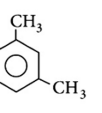
and



D)



and



74. Which of the following compounds will not undergo Friedal-Craft's reaction easily?

- A) Nitrobenzene
B) Toluene
C) Cumene
D) Xylene

75. The reaction of toluene with Cl_2 in presence of $FeCl_3$ gives 'X' and reaction in presence of light gives 'Y'. Thus, 'X' and 'Y' are:

- A) X - Benzal chloride, Y = o-chlorotoluene
B) X = m-chlorotoluene, Y = p-chlorotoluene
C) X-o- and p-chlorotoluene, Y = Trichloromethyl benzene
D) X = Benzyl chloride, Y = m-chlorotoluene

76. Benzene reacts with CH_3Cl in the presence of anhydrous $AlCl_3$ to form:

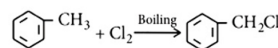
- A) chlorobenzene
B) benzyl chloride
C) xylene
D) toluene

77. Using anhydrous $AlCl_3$ as catalyst, which one of the following reactions produces ethylbenzene (PhEt)?

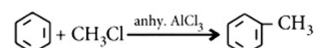
- A) $H_3C - CH_2OH + C_6H_6 \xrightarrow{\text{Boiling}}$
B) $CH_3 - CH = CH_2 + C_6H_6 \xrightarrow{\text{anhy. } AlCl_3}$
C) $H_2C = CH_2 + C_6H_6$
D) $H_3C - CH_3 + C_6H_6$

78. Which one of the following is a free-radical substitution reaction?

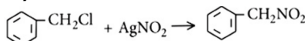
A)



B)



C)



D)



79. The correct order of reactivity towards the electrophilic substitution of the compounds aniline (I), benzene (II) and nitrobenzene (III) is:

- A) III > II > I
B) II > III > I
C) I < II > III
D) I > II > III

80. In Friedel-Crafts reaction, toluene can be prepared by:

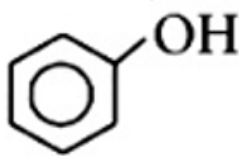
- A) $C_6H_6 + CH_3Cl$
B) $C_6H_5Cl + CH_4$
C) $C_6H_6 + CH_2Cl_2$
D) $C_6H_6 + CH_3COCl$

81. In Friedel-Crafts alkylation, besides $AlCl_3$ the other reactants are:

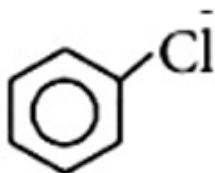
- A) $C_6H_6 + CH_3Cl$
B) $C_6H_6 + CH_4$
C) $C_6H_6 + NH_3$
D) $C_6H_6 + CH_3COCl$

82. Which of the following compounds will be most easily attacked by an electrophile?

A)



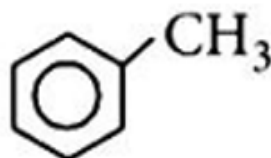
B)



D)



C)



83. Which one of these is not compatible with arenes?

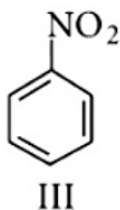
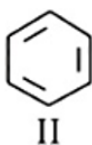
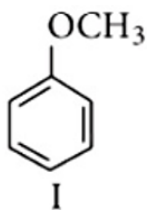
A) Electrophilic additions

B) Delocalisation of π -electrons

C) Greater stability

D) Resonance

84. Among the following compounds (I-III) the correct reaction with electrophile is:



A) I > II > III

B) I = II > III

C) II > III > I

D) III < I < II

85. Electrophile in the case of chlorination of benzene in the presence of $FeCl_3$ is:

A) Cl

B) $FeCl_3$

C) Cl^+

D) Cl^-

86. The reactive species in the nitration of benzene is:

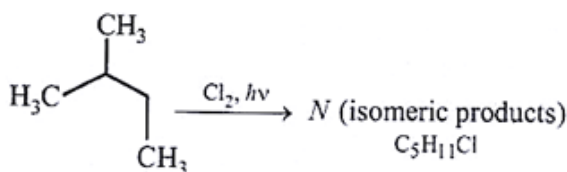
A) NO_3

B) HNO_3

C) NO_2^+

D) NO_2^-

87.



A) 6, 4

B) 6, 6

C) 4, 4

D) 3, 3

88. Statement I: Iodination of alkane is reversible
reaction Statement II: The formed HI in this reaction reduces RI in to alkane

A) Both are correct

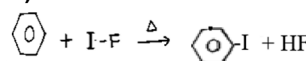
B) Both are wrong

C) Statement I is correct but Statement II is wrong

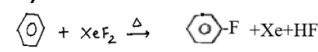
D) Statement I is wrong but Statement II is correct

89. Which of the following reaction is swart reaction?

A)



B)



C) $R-H + AgF \xrightarrow{\Delta} R-F + AgI$

D) $R-H + I_2 \xrightarrow{HNO_3} R-I$

90. Reactivity of hydrogen atoms attached to different carbon atoms in alkanes has the order:

A) tertiary > primary > secondary

B) primary > secondary > tertiary

C) both (a) and (b)

D) tertiary > secondary > primary

Botany

91. "A plant after decapitation becomes bushy". The possible reason of above phenomenon is

A) Removal of apical buds promote growth of lateral buds into branches

B) Removal of apical buds induce stem elongation as auxin suppresses production of gibberellins

C) Apical buds release some hormone which kills lateral buds

D) Lateral buds have auxins which are suppressed in presence of cytokinin

92. Given below are two statements: One is labelled as Assertion (A) and other is labelled as Reason (R). Assertion (A): Absciscic acid is known as stress hormone. Reason (R): Synthesis of ABA is stimulated by drought, water logging and other adverse environmental conditions and it increases the tolerance of plants towards it. In the light of the above statements, choose the correct answer from the options given below:

A) Both Assertion & Reason are true and the reason is the correct explanation of the assertion
C) Assertion is true statement but Reason is false

B) Both Assertion & Reason are true but the reason is not the correct explanation of the assertion
D) Both Assertion and Reason are false statements

93. Plants follows different pathways in response to environment or phases of life to form different kinds of structures this ability is called :

A) Plasticity

B) Maturity

C) Elasticity

D) Flexibility

94. Select the incorrectly matched pair.

- A) Auxins – stimulates shoot formation on stem cuttings
 B) Cytokinin – Delay the senescence of intact leaves
 C) Gibberellins – Increase the length of grapes stalks
 D) Ethylene – Accelerates shedding of leaves, flowers and fruits

95. Removal of shoot tips is a very useful technique to boost the production of tea leaves this is because :

- A) Gibberellins present bolting and are inactivated
 B) Auxins prevent leaf drop at early stages
 C) Effect of auxins is removed and growth of lateral buds is enhanced
 D) Gibberellins delay senescence of leaves

96. It takes very long time for pineapple plants to produce flowers which combination of hormones can be applied to artificially induce flowering in pineapple plants throughout the year to increase yield :

- A) Cytokinin and abscisic acid
 B) Auxin and ethylene
 C) Gibberellin and cytokinin
 D) Gibberellin and abscisic acid

97. You are given a tissue with its potential for differentiation in an artificial culture which of the following pairs of hormones would you add to the medium to secure shoots as well as roots ?

- A) IAA and Gibberellin
 B) Auxin and cytokinin
 C) Auxin and abscisic acid
 D) Gibberellin and abscisic acid

**98. Read the following Assertion (A) and Reason (R)
 Assertion (R) : Several hormonal and structural changes are initiated which lead to the differentiation and further development of the floral primordium. Reason (A) : Shoot apical meristem transforms into floral meristem**

- 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) Both (A) and (R) are false
 D) (A) is true but (R) is false

99. Select the correct option for the hormone which was first isolated from human urine.

- A) Widely applied in tea-plantations for hedge-making
 B) Controls xylem differentiation and helps in cell division
 C) Acidic and is used to increase the length of grapes stalks
 D) Induces seed and bud dormancy

100.

If the apical bud has been removed then we observe :

- A) More lateral branches
 B) More axillary buds
 C) Plant growth stops
 D) Flowering stops

101.

Who coined the term kinetin:

- A) Skoog and miller
 B) Cousin
 C) F.W. Went
 D) Kurosawa

102.

Match the column-I with column-II

	Column-I		Column-II
a.	E. Kurosawa	i.	He confirmed the release of a volatile substance from ripened oranges
b.	Miller et al.	ii.	He reported the appearance of symptoms of the foolish seedling in rice when they were treated with sterile filtrate fungus.
c.	F.W. Went	iii.	Identified crystallised and the cytokinesis promoting active substance
d.	H.H. Cousins	iv.	Isolated an indole compound from tips of coleoptiles of oat seedlings

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

103.

Cork, secondary cortex and secondary xylem are formed through

- A) Dedifferentiation
 B) Redifferentiation
 C) Differentiation
 D) Obliteration

104.

At day one, the area of leaf A was 10 cm^2 and that of leaf B was 100 cm^2 . On next day, area of leaf B was 110 cm^2 and that of leaf A was 20 cm^2 . The relative growth rate of leaf B and A is

- A) 20% and 19%
 B) 100% and 10%
 C) 10% and 100%
 D) 11% and 20%

105.

Buttercup and coriander differ from each other in terms of development as in the former

- A) The plant follow different pathway in response to phases of life to form different kinds of structures
 B) The leaves of the juvenile plants are different in shape from those of mature plants.
 C) The sequence of the development process ultimately lead to senescence and then death
 D) There is difference in shape of leaves produced in air with those produced in water

106.

Which of the following statements are correct regarding growth? (A) In plants, form of growth is open and localised (B) Swelling of piece of wood in water is considered as growth since it involve the increase in size (C) Growth is accompanied by metabolic processes (D) Growth, at a cellular level, is a result of increase in the amount of protoplasm

- A) All the statements are correct
B) A and B
C) B, C and D
D) A, C and D

107.

Removal of shoot tips is a very useful technique to boost the production of tea leaves. This is because:

- A) Gibberellins prevent bolting and are inactivated
B) Auxins prevent leaf drop at early stages
C) Effect of auxins is removed and growth of lateral buds is enhanced.
D) Gibberellins delay senescence of leaves

108.

One of the commonly used plant growth hormone in tea plantations is - :

- A) Absciscic acid
B) Zeatin
C) Indole -3- acetic acid
D) Ethylene

109.

The three phases of growth in correct order is-

- A) Meristematic, maturation, elongation
B) Elongation, meristematic, maturation
C) Meristematic, elongation, maturation
D) Elongation, maturation, meristematic

110.

Given below are two statements: Statement-I : Plant growth is unique because plants retain the capacity for unlimited growth throughout their life. Statement-II : Growth, at a cellular level, is principally a consequence of increase in the amount of protoplasm. In the light of the above statements, choose the most appropriate answer from option given below

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

111.

Given below are two statements; one is labelled as Assertion (A) and the other is labelled as Reason(R) . Assertion (A) : Development is a term that includes all changes that an organism goes through during its life cycle. Reason (R) : Plants follow different pathways in response to environment or phases of life to form different kinds of structure. Choose the most appropriate answer from the options given below :

- A) Both (A) & (R) are correct but (R) is not the correct explanation of (A).
B) (A) is correct but (R) is not correct.
C) (A) is not correct but (R) is correct.
D) Both (A) & (R) are correct and (R) is the correct explanation of (A).

112.

Match the following

- (A) Human urine (i) Ethylene
(B) Coconut milk (ii) GA3
(C) Ripened oranges (iii) Auxin
(D) Gibberella fujikuroi (iv) Cytokinin

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

113.

Which of the following phenomenon in plants requires interaction of more than one plant growth regulator :-

- A) Dormancy in seeds/buds
B) Apical dominance
C) Senescence
D) All of the above

114.

(i) Promote nutrient mobilisation, (ii) Overcome the apical dominance, (iii) Lateral shoot growth. All the above physiological effects are related to which of the following plant growth regulators?

- A) Auxins
B) Gibberellins
C) Absciscic acid
D) Cytokinins

115.

The plant growth regulators (PGRs) are

- A) Simple organic substances of different chemical composition
B) Complex organic substances of different chemical composition
C) Simple and complex organic substances of same chemical composition
D) Small organic substances of same chemical composition

116.

Identify the correct set of statements : (a) Cytokinins helps to promote apical dominance. (b) Ethylene is synthesised in large amounts by tissues undergoing senescence and ripening fruit. (c) ABA plays an important role in seed development, maturation and dormancy. (d) Seed dormancy is when seeds fail to germinate even with external conditions are favourable.

- A) a, b and c only B) b, c and d only
C) a, c and d only D) a, b and d only

117.

Match the following

Column I	Column II
a. Weedicide	(i) GA ₃
b. Bolting	(ii) Cytokinin
c. Thinning of cotton	(iii) Ethylene
d. Lateral shoot growth	(iv) 2, 4-D

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

118.

Which of the following was one of the first gibberellins to be discovered and is the most intensively studied form?

- A) GA₁ B) GA₂
C) GA₃ D) GA₄

119.

Which of the following is a derivative of acetyl CoA and also responsible for delaying the ripening of fruits?

- A) Gibberellin B) Auxin
C) Cytokinin D) ABA

120.

Given below are two statements: Statement-I : One single maize root apical meristem can give rise to more than 17,500 new cells per day. Statement-II : Cells in watermelon may increase in size by up to 3,50,000 times. Choose the most appropriate answer

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

121.

“Avena” coleoptile curvature test is used for bioassay of a hormone ‘X’. ‘X’ can be artificially used to a. Induce parthenocarpy in tomatoes. b. Promote shooting in callus. c. Remove dicot weeds from crop fields.

- A) a only B) b only
C) b and c D) a and c

122.

During geometric growth of an organism, the initial phase is

- A) Lag phase B) Exponential phase
C) Log phase D) Stationary phase

123.

Plant growth as compared to animals is unique because

- A) It is accompanied by metabolic processes, that occur at the expense of energy B) They retain the capacity for unlimited growth throughout their life due to presence of meristems
C) Growth in plants is at the tips only D) There is an irreversible permanent increase in size of an organ or its part or even of an individual cell

124.

Identify the PGRs that naturally occur in plants: (a) Kinetin, (b) IAA, (c) 2, 4 – D, (d) Zeatin, (e) GA₃

- A) (a), (b) and (d) B) (b), (d) and (e)
C) (a) and (c) D) (a), (b), (d) and (e)

125.

Development in plants is controlled by

- A) PGR only B) Environmental, genetic and intercellular factors
C) Intracellular factors only D) Intrinsic factors only

126.

Abscission promoting growth hormones are

- A) Auxin and cytokinin B) Ethylene and Gibberellin
C) Cytokinin and ABA D) ABA and ethylene

127.

The cells proximal to meristematic zone have/show: (a) Large conspicuous nuclei, (b) Thin cellulosic cell wall, (c) Increased vacuolation, (d) New cell wall deposition, (e) High rate of cell division

- A) (a), (b) and (e) only B) (b), (c) and (d) only
C) (c) and (d) only D) (a) and (e) only

128.

Apical dominance can be counteracted by

- A) Application of ethylene B) Application of Cytokinin
C) Removal of lateral buds D) Providing auxins to plant

129.

Dormancy of seeds is induced by hormone that also

- A) Inhibits the protein and RNA synthesis in leaves B) Induces fruit ripening
C) Activates the α -amylase in seeds D) Induces rooting and root hair formation

130.

Identify the correct set of statements : (a) A sigmoid curve is a characteristic of living organisms growing in a natural environment. (b) Differentiated cells can regain the capacity to divide is termed as dedifferentiation. (c) The plant growth regulators are small simple molecules of diverse chemical composition. (d) Auxin was isolated by F.W. Went from tips of coleoptiles of oat seedlings.

- A) a, b and c only B) b, c and d only
C) a, c and d only D) a, b, c and d

131.

A phytohormone that helps the plants to increase their absorption surface by promoting root hair formation is

- A) Gibberellic acid B) Ethylene
C) Zeatin D) Cytokinin

132.

Read the following w.r.t. auxin. i. It has been extensively used in agricultural practices. ii. It promotes fruit and leaf drop at early stages of plant. iii. It was first isolated from tip of coleoptile of oat. iv. It is composed of indole compound. The correct ones are

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

133.

Auxin helps in all, except

- A) Apical hook formation B) Apical dominance
C) Cell division D) Xylem differentiation

134.

All the given plant tissues are re-differentiated, except.

- A) Secondary phloem B) Secondary xylem
C) Cork D) Cork cambium

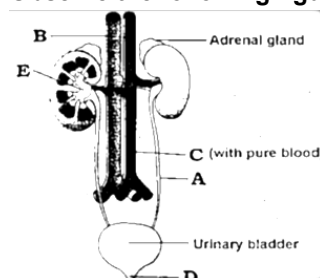
135.

Flowering in pineapple is promoted by

- A) Auxin and ABA B) Cytokinin and ethylene
C) Auxin and ethylene D) ABA and cytokinin

136.

Observe the following figure.



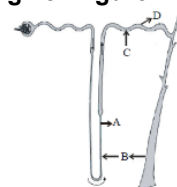
Identify A to E

structure.

- A) A-Superior vena cava, B-Inferior vena cava, C-Dorsal Aorta, D-Urethra, E-Pelvis
B) A-Inferior vena cava, B-Superior vena cava, C-Dorsal Aorta, D-Urethra, E-Pelvis
C) A-Urethra, B-Inferior vena cava, C-Dorsal Aorta, D-Urethra, E-Pelvis
D) A-Dorsal Aorta, B-Inferior vena cava, C-Urethra, D-Cortex, E-Pelvis

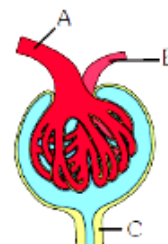
137.

Reabsorption and secretion of major substances at different parts of the Nephron are shown in the given figure. In this figure A, B, C, D are:-



- A) HCO_3^- , Nutrients, Urea, NaCl B) NaCl, Urea, K^+ , HCO_3^-
C) NaCl, Urea, HCO_3^- , Ammonia D) H_2O , Urea, Nutrients, HCO_3^-

138.



Consider the given figure— In above figure A, B and C respectively represents—

- A) Afferent arteriole, Efferent arteriole and Proximal convoluted tubule
B) Efferent arteriole, Proximal convoluted tubule and Afferent arteriole
C) Afferent arteriole, Proximal convoluted tubule and Efferent arteriole
D) Bowman's capsule, Proximal convoluted tubule and Afferent arteriole

139.

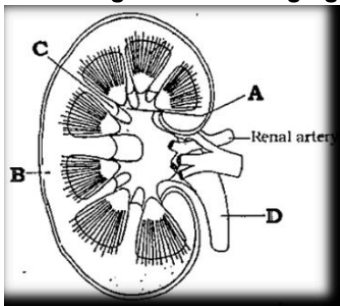
Different types of excretory structures and animals are given below. Match the appropriately and mark the correct answer from among those given below.

Excretory structure	Animals/organ
A. Protonephridia	i. Prawn
B. Nephridia	ii. Cockroach
C. Malpighian tubules	iii. Earthworm
D. Green gland or Antennal gland	iv. Flatworms

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

140.

Go through the following figure-

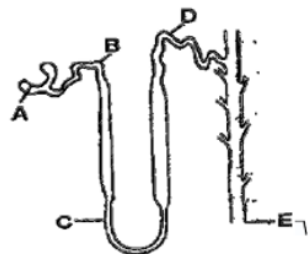


Identify A to D

- A) A-Cortex, B-Calyx, C-Renal Column, D-Ureter
 B) A-Calyx, B-Cortex, C-Renal Column, D-Ureter
 C) A-Medulla, B-Cortex, C-Renal Column, D-Urethra
 D) A-Calyx, B-Cortex, C-Renal Column, D-Urethra

141.

Use following diagram to complete the statements about the human nephron –

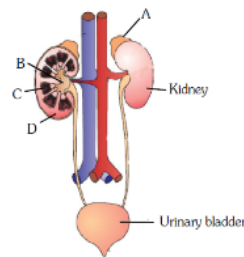


I. The composition of the filtrate would be most like plasma in the tubule next to the letter. II. The urine would be most concentrated in the collecting duct next to letter III. Most of the glomerular filtrate is reabsorbed into peritubular capillary next to the letter IV. Conducting of urine to pelvis of the kidney from the structure next to the letter V. Most water is reabsorbed by the structure next to the letter

- A) I-A, II-C, III-B, IV-E, V-D
 B) I-A, II-E, III-B, IV-C, V-D
 C) I-A, II-B, III-E, IV-C, V-D
 D) I-A, II-E, III-B, IV-E, V-B

142.

Figure shows human urinary system with structures labeled A to D. Select option which correctly identifies them and gives their characteristics and/or functions.



- A) D-Cortex - outer part of kidney and do not contain any part of nephrons
 B) A-Adrenal gland - located at the anterior part of kidney. Secrete aldosterone.
 C) B-Pelvis - broad funnel shaped space inner to hilum, directly connected to zoops of Henle
 D) C-Medulla-inner zone of kidney and contains complete nephrons

143.

Match the column I with column II.

	Column I		Column II
A	Nephridia	I	Crustaceans (Prawn)
B	Malpighian tubules	II	Annelids (Earthworm)
C	Anteenal Gland or Green Glands	III	Insects (Cockroach)

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

144.

Match the terms given in column – I with their physiological processes given in column – II and choose the

	Column – I		Column – II
A	Proximal convoluted tubule	(i)	Formation of concentrated urine
B	Distal convoluted tubule	(ii)	Glomerular filtration
C	Henle's loop	(iii)	Reabsorption of 70 – 80% of electrolytes
D	Counter-current mechanism	(iv)	Ionic balance
E	Renal corpuscle	(v)	Maintenance of concentration gradient in medulla

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

145.

Consider the following four statements and identifies the true (T) and false (F) ones. (i) Proximal convoluted tubule is lined by simple cuboidal epithelium with brush border. (ii) Absorption of water in Proximal convoluted tubule is called conditional water reabsorption. (iii) Protein free fluid is filtered from blood plasma into the Bowman's capsule (iv) Glucose is actively reabsorbed in the Proximal convoluted tubule.

- A) i-T, ii-F, iii-T, iv-F
 B) i-F, ii-T, iii-F, iv-T
 C) i-T, ii-F, iii-T, iv-T
 D) i-F, ii-T, iii-T, iv-T

146.

Match Column I with Column II

Column-I (Excretory organs)		Column-II (Animals)	
(A)	Nephridia	(1)	Hydra
(B)	Malpighian tubules	(2)	Leech
(C)	Protonephridia	(3)	Shark
(D)	Kidneys	(4)	Round worms
		(5)	Cockroach

A) A → 2; B → 5; C → 4; D → 3
B) A → 4; B → 2; C → 1; D → 5

C) A → 5; B → 2; C → 1; D → 5
D) A → 2; B → 4; C → 5; D → 1

147.

Each kidney of adult human measures-

	Length	Width	Thickness	Weight
a)	10 - 12 Cm	5 - 7cm	2 - 3 cm	120-170 g
b)	10 - 20 Cm	10 - 12 Cm	6 - 12 cm	40-50 gm
c)	2 - 6 cm	10 - 12 Cm	6 - 12 cm	40-50 gm
d)	10 - 12 Mm	5 - 7 Mm	2 - 3 mm	120-170 mg

A) a
B) b
C) c
D) d

148.

Pick the odd ones in each of the following groups and select the correct option. A) Afferent arteriole, Henle's loop, Efferent arteriole, Peri tubular capillary B) PCT, DCT, Henle's loop, Renal Pelvis C) Ultra filtration, Micturition, Reabsorption, Tubular Secretion. D) Medullary Pyramid, Renal Cortex, columns of Bertini, Renal corpuscle.

A) A-Henle's loop, B-DCT, C-Tubular secretion, D-Renal cortex
B) A-Peri tubular capillary, B-Renal pelvis, C-Micturition, D-Renal cortex
C) A-Peri tubular capillary, B-Henle's loop, C-Ultra filtration, D-Renal corpuscle
D) A-Henle's loop, B-Renal Pelvis, C-Micturition, D-Renal corpuscle

149.

Match the column I with column II.

	Column I		Column II
A	Delivers blood to glomerulus	I	Ascending and descending limb
B	Carries urine to pelvis, also acts in water reabsorption	II	Renal artery
C	Collects filtrate from Bowman's capsule	III	Collecting duct
D	Loop of Henle	IV	PCT

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

150.

Match the column I with column II.

	Column I		Column II
a	PCT	I	Concentrated urine formation
b	DCT	II	Filtration of blood
c	Loop of Henle	III	Reabsorption of 70 - 80% electrolytes
d	Counter current mechanism	IV	Ionic balance
e	Renal corpuscle	V	Maintenance of conc. gradient in medulla

A) a-III, b-IV, c-I, d-V, e-II
B) a-III, b-V, c-IV, d-II, e-I
C) a-I, b-III, c-II, d-V, e-IV
D) a-III, b-I, c-IV, d-V, e-II

151.

Match the following:

Column - I		Column - II	
A	Loop of Henle	(i)	Carries blood into the kidney
B	Renal artery	(ii)	Area where maximum amount of reabsorption takes place
C	Proximal convoluted tubule	(iii)	Area of secretion
D	Glomerulus	(iv)	Filtration of blood
E	Distal convoluted tubule	(v)	Plays a role in reducing the volume of urine

A) A = (v), B = (i), C = (ii), D = (iv), E = (iii)
B) A = (iv), B = (v), C = (i), D = (iii), E = (iv)
C) A = (i), B = (v), C = (iii), D = (iv), E = (ii)
D) A = (ii), B = (iii), C = (i), D = (iv), E = (v)

152.

Match the items of Column - I with those of Column - II

Column - I		Column - II	
A	Ammonotelism	(i)	Birds
B	Bowman's capsule	(ii)	Water reabsorption
C	Micturition	(iii)	Bony fish
D	Uricotelism	(iv)	Urinary bladder
E	ADH	(v)	Renal tubule

A) A = (iii), B = (v), C = (iv), D = (i), E = (ii)
B) A = (iii), B = (iv), C = (v), D = (i), E = (ii)
C) A = (i), B = (ii), C = (v), D = (iv), E = (iii)
D) A = (i), B = (ii), C = (v), D = (iii), E = (iv)

153.

Match the following

Column - I		Column - II	
A	PCT	(i)	Selective secretion of H^+ and K^+ ions
B	DCT	(ii)	70 - 80 percent of electrolytes and water reabsorbed
C	Descending limb	(iii)	Allow passage of small amount of urea
D	Ascending limb	(iv)	Permeable for water
E	Collecting duct	(v)	Permeable to salts

A) A = (i), B = (ii), C = (iii), D = (iv), E = (v)
B) A = (i), B = (iii), C = (iv), D = (ii), E = (v)
C) A = (ii), B = (i), C = (iv), D = (v), E = (iii)
D) A = (ii), B = (i), C = (v), D = (iv), E = (iii)

154.

Which of the following statements is correct?

A) Many bony fishes, aquatic amphibian and ammoniotelic
B) Ammonia is readily soluble
C) NH_3 is generally excreted by the body surface or through gills (in fishes) as NH_4^+
D) D)All

155.

Find out the incorrect pairing with respect to part of nephron and position in kidney-

A) Malpighian corpuscle - cortex of kidney
B) PCT - cortex of kidney
C) DCT - medulla of kidney
D) Loop of Henle - medulla of kidney

156.

If A, B, C are representing the solubility of uric acid, ammonia and urea in water respectively and X, Y, Z represent toxicity of uric acid, ammonia and urea respectively, then which of the following is correct option?

- A) $A > B > C$; $X > Y > Z$ B) $B > C > A$; $Z > Y > X$
C) $B > C > A$; $Y > Z > X$ D) $C > B > A$; $Y > Z > X$

157.

Read the following statements: A) Dialysis fluid contain all the constituents as in plasma except ____ (a) ____ B) A chordate animal having flame cells as excretory structure is ____ (b) ____ C) Reabsorption of water from distal parts of the tubule is facilitated by hormone ____ (c) ____ . In the above statement(s) (A), (B) and (C) are :

- A) Glucose, Planaria, ADH B) Nitrogenous wastes, Planaria, ANF
C) Nitrogenous wastes, Amphioxus, ADH D) NaCl, rotifers, aldosterone

158.

How many statements are correct? A) Podocytes cells are found in outer wall of Bowman's capsule B) Yellow colour of urine is due to Urochrome C) Renal artery contain nitrogenous wastes D) Renal vein is without nitrogenous wastes E) Filtration slits of PCT increases the area of water absorption.

- A) Four B) Five
C) Three D) Two

159.

Identify the correct combination: A. Cardiac output – 5040 ml /minute B. Glomerular filtration – 125 ml /minute C. Renal artery – 1100 – 1200 ml/minute D. Glomerular filtrate – 180 litres/day E. Renal tubular reabsorption – 178. 5 litres /day.

- A) A B C ONLY B) A B D ONLY
C) A B C D ONLY D) A, B, C, D, E ONLY.

160.

Consider the following four statements (a-d) select the option which includes all the correct. a) Henle's loop plays a significant role in the maintenance of high osmolarity of medullary interstitial fluid. b) Collecting duct plays a role in the maintenance of pH and ionic balance of blood by the selective secretion of H^+ and K^+ ions. c) Conditional reabsorption of Na^+ and water takes place in DCT. d) Nearly all of the essential nutrients and 70 -80 per cent of electrolytes and water are reabsorbed by DCT.

- A) Statements (a), (b), (c) B) Statements (a), (c), (d)
C) Statements (b), (c) D) Statements (c), (d)

161.

Which one of the following statement is incorrect?

- A) The medullary zone of kidney is divided into a few conical masses called medullary pyramids projecting into the calyces. B) Inside the kidney, the cortical region extends in between the medullary pyramids as renal pelvis.
C) Glomerulus along with Bowman's capsule is called the renal corpuscle. D) Renal corpuscle, proximal convoluted tubule (PCT) and distal convoluted tubule (DCT) of the nephron are situated in the cortical region of kidney.

162.

Which statement is not true with the regarding of reabsorption?

- A) Nearly 99 per cent of the filtrate has to be reabsorbed by the renal tubules B) Nearly all of the essential nutrient are reabsorbed by PCT.
C) DCT is also capable of reabsorption of HCO_3^- D) Reabsorption of hydrogen and potassium ions occur in DCT

163.

Which of the following group of animals are ammonotelic in nature ?

- A) Many bony fishes, amphibians, Insects. B) Marine Fishes, amphibians, aquatic insects
C) Mammals, birds, Reptiles D) Many bony fishes, aquatic amphibians, aquatic insects.

164.

Which statement is not correct about glomerular filtration?

- A) On an average 1100 – 1200 mL of blood is filtered by the kidney per minute. B) Glomerular filtrate is blood plasma except protein
C) GFR in a healthy individual is approximately 125 mL/minute or 180 litre per day D) Complete blood plasma is filtered in ultrafiltration process.

165.

Which statement is correct about the mechanism of concentration of the filtrate:

- | | |
|---|---|
| A) NaCl is transported by the ascending limb of Henle's loop which is exchanged with the ascending limb of vasa recta | B) NaCl is transported by the descending limb of Henle's loop which is exchanged with the ascending limb of vasa recta |
| C) NaCl is transported by the ascending limb of Henle's loop which is exchanged with the descending limb of vasa recta | D) Small amount of urea enter the thin segment of the descending limb of vasa recta which is transported back to the interstitium by the collecting tubule |

166.

Consider the following statements and select the correct ones out of these 1) Flame cells are excretory structures in flatworms 2) Green glands are excretory organs in annelids. 3) ANF can cause vasodilation (dilation of blood vessels) and thereby increase the blood pressure.

- | | |
|-----------------------------------|--|
| A) (1) and (2) are correct | B) (2) and (3) are incorrect |
| C) (1) and (3) are correct | D) (1), (2) and (3) are correct |

167.

Which of the following statements is wrong?

- | | |
|--|---|
| A) Kidney does not play any significant role in the removal of ammonia | B) Ureotelic animals excrete most of the nitrogenous waste as urea |
| C) Ammonia and urea are the waste products derived from the metabolic breakdown of proteins | D) None of the above is wrong |

168.

Which of the following is correct about protonephridia/flame cells?

- | | |
|--|--|
| A) Protonephridia are the excretory structures in Platyhelminthes (e.g. Planaria), rotifers and some annelids | B) Protonephridia are the excretory structures in the cephalochordates e.g. Amphioxus |
| C) Protonephridia are primarily concerned with ionic and fluid volume regulation i.e. osmoregulation | D) All |

169.

Which of the following statements is wrong about the human excretory system?

- | | |
|--|---|
| A) Excretory system consists of one pair of bean shaped kidneys, one pair of ureter, a urinary bladder and a urethra. | B) Kidneys are situated between the 12th thoracic and 3rd lumbar vertebrae close to the dorsal wall in abdominal cavity. |
| C) Right kidney is a little higher level than the left one. | D) All |

170.

Which of the following statements are false? (i) Outer cortex and inner medulla are the two zones in kidney (ii) Glomerulus is a tuft of capillaries formed by the efferent arteriole – a fine branch of renal artery. (iii) Kidneys are reddish brown, bean shaped structures situated between the levels of last thoracic and third lumbar vertebra close to the dorsal inner wall of the abdominal cavity. (iv) Inward extension of cortex between the pyramids is called renal column of Bertini.

- | | |
|--------------------------|-------------------------|
| A) (i) and (iv) | B) (ii) and (iv) |
| C) (ii) and (iii) | D) None of these |

171.

Which of the following statements is false?

- | | |
|---|---|
| A) Renal tubule starts with a double walled cup like structure called Bowman's capsule | B) In majority of nephrons, the loop of Henle is too short and such nephrons are cortical nephrons |
| C) Juxta medullary nephron has long loop of Henle | D) None |

172.

Which 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 |

173.

Which of the following is correct about Juxta medullary nephrons?

- | | |
|--|---------------------------------|
| A) Vasa recta is prominent | B) Loop of Henle is long |
| C) NaCl is returned to the interstitium by ascending limb of vasa recta | D) All |

174.

Which of the following places the region of nephron in their correct sequence with respect to flow of tubular fluid?

- A) PCT → Descending limb of Henle (DLH) → Ascending limb of Henle (ALH) → DCT → Collecting duct (CD)
B) PCT → ALH → DLH → OCT → CD
C) ALH → DLH → PCT → OCT → CD
D) OCT → ALH → DLH → PCT → CD

175.

Which of the following is incorrect?

- A) Blood vessel leading to glomerulus is called efferent arteriole
B) Vasa recta, peritubular capillaries, Glomerulus all have blood
C) Cortical nephron has no or highly reduced vasa recta
D) Vasa recta runs parallel to the Henle's loop in juxtamedullary nephrons

176.

Which of the following statements is correct? I. Renal vein take blood away from kidney II. Loop of Henle conserves water III. Podocytes occur in inner wall of Bowman's capsule IV. Ultrafiltrate I nephric filtrate is plasma minus proteins.

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

177.

Which of following statements is false?

- A) The kidney has built in mechanism for regulation of GFR
B) Tubular secretion does not play any significant role in urine formation
C) The amount of urine output per day in normal adult is about 1.5 L
D) During urine formation tubular cells secrete H^+ , K^+ and NH_3 in the filtrate

178.

Which of the following statements about proximal convoluted tubule (PCT) is false?

- A) It is lined by simple cuboidal brush border epithelium which increases the surface area
B) Nearly all the essential nutrients, 70 - 80% electrolytes, 70% H_2O are reabsorbed by PCT
C) PCT is not the site of selective secretion
D) PCT helps to maintain the pH and ionic balance of body fluids

179.

I. Reabsorption in this region is minimum. II. This region plays a significant role in the maintenance of high osmolarity of intestinal fluid III. Its descending limb is permeable to water but almost impermeable to electrolytes IV. Its ascending limb is impermeable to water but allows transport of electrolyte actively or passively V. In descending limb filtrate is hypertonic while in ascending limb filtrate is hypotonic The above characteristics are associated with -

- A) PCT
B) Loop of Henle
C) DCT
D) Bowman's capsule

180.

Which of the following statements is correct? I. Reabsorption of water occurs passively in the initial segment of nephron II. Nitrogenous waste are absorbed by passive transport III. Conditional reabsorption of Na^+ and water takes place in DCT IV. DCT reabsorbs HCO_3^- - V. DCT is capable of selective secretion of H^+ , K^+ and NH_3 to maintain pH and Na^+ - K^+ balance in blood VI. Substances like glucose, amino acids, Na^+ , etc in the filtrate are reabsorbed actively

- A) I and II
B) II and III
C) IV and V
D) All

ANSWER KEY

Physics

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

Chemistry

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

Botany

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

Zoology

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

SOLUTIONS

Q1.

Answer: B

Explanation:

For a charged conductor in electrostatic equilibrium, the interior electric field is always zero because any excess charge resides entirely on the outer surface. The electric potential inside is not zero, but constant and equal to the potential at the surface, given by $V = \frac{1}{4\pi\epsilon_0} \frac{Q}{R}$.

Q2.

Answer: A

Explanation:

The change in potential energy

$\Delta U = U_{final} - U_{initial} = PE(\cos \theta_i - \cos \theta_f)$. Here, $\theta_i = 180^\circ$ and $\theta_f = 0^\circ$.

Q3.

Answer: B

Explanation:

The work done by an external agent in rotating an electric dipole in a uniform electric field is given by the change in its potential energy, $W = U_f - U_i$. Using the potential energy formula $U = -PE \cos \theta$, we find $W = PE(\cos \theta_i - \cos \theta_f)$.

Q4.

Answer: B

Explanation:

When the uncharged sphere touches the first sphere, they share the total charge equally. After touching the second sphere, the remaining charge is redistributed, changing the final force calculated via Coulomb's Law.

Q5.

Answer: A

Explanation:

After the contact process, the charge on A becomes $q/2$ and the charge on B becomes $3q/4$. When sphere C (which carries a charge of $3q/4$ after the second contact) is placed at the midpoint, it experiences repulsive forces from both A and B. By calculating these forces and considering their directions, the net force is found to be zero because the forces cancel each other out in terms of magnitude when considering the specific charge distributions.

Q6.

Answer: A

Explanation:

The surface area of a sphere is $A = 4\pi R^2$. The surface charge density is $\sigma = Q/A$. Given $\pi \approx 3.14$, the calculation simplifies effectively.

Q7.

Answer: A

Explanation:

The surface charge density σ is calculated by dividing the total charge Q by the surface area of the sphere $A = 4\pi r^2$. Converting units to SI, we calculate $\sigma = \frac{Q}{4\pi r^2}$.

Q8.

Answer: A

Explanation:

The electric potential V due to a point charge q at a distance r is given by the formula $V = \frac{1}{4\pi\epsilon_0} \frac{q}{r}$. By substituting the given values into this formula, we can determine the potential.

Q9.

Answer: A

Explanation:

The electric potential V at a distance r from a point charge q is $V = \frac{1}{4\pi\epsilon_0} \frac{q}{r}$. We use the given constants and values to compute V .

Q10.

Answer: A

Explanation:

According to Gauss's Law, the total electric flux Φ through any closed surface is equal to the net charge q enclosed by the surface divided by the permittivity of free space ϵ_0 .

Q11.

Answer: C

Explanation:

An electric dipole consists of two equal and opposite charges, $+q$ and $-q$. The total net charge enclosed by any surface surrounding the dipole is $q + (-q) = 0$. By Gauss's Law, the net flux is proportional to the net enclosed charge.

Q12.

Answer: A

Explanation:

According to Gauss's Law, the total electric flux through a closed surface depends only on the net charge enclosed by the surface and the permittivity of free space. It is independent of the size or shape of the Gaussian surface.

Q13.

Answer: C

Explanation:

According to Gauss's Law, the total flux through the cube is $\frac{q}{\epsilon_0}$. Due to the symmetry of the cube, the flux through each of its 6 faces is exactly one-sixth of the total flux.

Q14.

Answer: A

Explanation:

For a point outside a uniformly charged spherical shell, the shell behaves as if all its charge were concentrated at the center. Using Coulomb's law, the electric field is $E = \frac{kq}{r^2}$.

Q15.

Answer: B

Explanation:

The potential at the surface is $V = \frac{kq}{R}$. The electric field at a distance r is $E = \frac{kq}{r^2}$. By substituting $kq = VR$, we can express the electric field in terms of V .

Q16.

Answer: A

Explanation:

The torque τ on an electric dipole is given by $\tau = pE \sin(\theta)$. When the torque is at its maximum, $\sin(\theta) = 1$, which occurs when the dipole is perpendicular to the electric field ($\theta = 90^\circ$).

Q17.

Answer: A

Explanation:

According to Gauss Law, the total electric flux through a closed surface is equal to the total enclosed charge divided by the permittivity of free space (ϵ_0). Since the enclosed charge remains q regardless of its position inside the shell, the total flux remains unchanged.

Q18.

Answer: D

Explanation:

The electric potential V at the surface of a charged conducting sphere is given by $V = \frac{Kq}{R}$. Since both spheres have equal charges q , the potential is inversely proportional to the radius ($V \propto \frac{1}{R}$). Therefore, the ratio of the potential of the larger sphere ($3r$) to the smaller sphere (r) is the inverse ratio of their radii.

Q19.

Answer: C

Explanation:

For an electric dipole at a point where the distance r is much larger than the dipole length l ($r \gg l$), the electric field due to the dipole is proportional to $1/r^3$ for both axial and equatorial points.

Q20.

Answer: B

Explanation:

Non-polar molecules are those where the centre of the positive charge distribution and the centre of the negative charge distribution coincide. As a result, they do not possess a permanent dipole moment in the absence of an external electric field.

Q21.

Answer: B

Explanation:

When two charged conductors are connected by a conducting wire, charges flow between them until they reach the same electrostatic potential. Therefore, their potentials become equal.

Q22.

Answer: A

Explanation:

The potential of a spherical drop is directly proportional to the total charge and inversely proportional to the radius. When drops combine, the volume remains constant, which relates the radius of the big drop to the small drop, and the total charge is conserved.

Q23.

Answer: D

Explanation:

When a large drop breaks into smaller ones, the total charge is conserved and split among the droplets, and the volume is conserved, leading to a decrease in potential for each individual small droplet.

Q24.

Answer: A

Explanation:

For a point on the axial line, the angle $\theta = 0^\circ$. Therefore, $\cos 0^\circ = 1$. The potential formula simplifies to $V = \frac{1}{4\pi\epsilon_0} \frac{p}{r^2}$.

Q25.

Answer: D

Explanation:

The electric potential V of a short electric dipole at a point (r, θ) is given by $V = \frac{1}{4\pi\epsilon_0} \frac{p \cos \theta}{r^2}$. Substituting the given values $p = 4 \times 10^{-9} \text{ Cm}$, $r = 0.2 \text{ m}$, and $\theta = 60^\circ$ yields the potential.

Q26.

Answer: C

Explanation:

For a uniformly charged spherical shell, the electric field at any point inside the shell ($r < R$) is always zero due to the cancellation of electric field contributions from different parts of the shell (as described by Gauss's Law).

Q27.

Answer: D

Explanation:

For a point outside a spherical conductor, the charge behaves as if it were concentrated at the centre. We use Coulomb's law for the electric field $E = \frac{1}{4\pi\epsilon_0} \frac{Q}{r^2}$ where r is the distance from the centre.

Q28.

Answer: C

Explanation:

For a solid conducting sphere, all excess charge resides on its outer surface. According to Gauss Law, for any Gaussian surface drawn inside the conductor (where $r < R$), the enclosed charge is zero. Consequently, the electric field inside a conductor in electrostatic equilibrium is always zero.

Q29.

Answer: B

Explanation:

The torque τ experienced by an electric dipole in a uniform electric field is given by $\tau = pE \sin \theta$, where $p = q \times l$ is the dipole moment. We can rearrange this to solve for the charge q .

Q30.

Answer: A

Explanation:

According to Gauss's Law, the total electric flux through a closed surface is equal to the enclosed charge divided by the permittivity of free space. We calculate the flux by integrating the electric field over the surface area of a sphere of radius R and equate it to q/ϵ_0 .

Q31.

Answer: B

Explanation:

For a uniformly charged non-conducting sphere, the potential at the centre is calculated by integrating the potential contribution from infinitesimal spherical shells from the centre to the surface. The potential at the centre is 1.5 times the potential at the surface.

Q32.

Answer: A

Explanation:

The work done in rotating an electric dipole in a uniform electric field is equal to the change in its potential energy, given by $W = U_f - U_i = -pE \cos \theta_f - (-pE \cos \theta_i) = pE(\cos \theta_i - \cos \theta_f)$.

Q33.

Answer: B

Explanation:

By symmetry, place another identical cube adjacent to the first one such that the charge q lies on the common face, becoming an internal point charge for the combined Gaussian surface (a rectangular parallelepiped of dimensions $a \times a \times 2a$). According to Gauss's law, the total flux through this closed surface is q/ϵ_0 . Since the charge is shared equally between the two cubes, the flux through one cube is half of the total flux.

Q34.

Answer: A

Explanation:

The work done by an external agent to rotate a dipole in an electric field is equal to the change in its potential energy, $W = U_f - U_i$. The potential energy of a dipole is given by $U = -pE \cos \theta$.

Q35.

Answer: C

Explanation:

According to Gauss's Law, the total electric flux passing through any closed surface is equal to the net charge enclosed by the surface divided by the permittivity of free space (ϵ_0). Since the charge q enclosed by the cube does not change regardless of the size of the cube, the total flux remains constant.

Q36.

Answer: A

Explanation:

For a uniformly charged solid non-conducting sphere, the electric field inside the sphere at a distance r' from the center is directly proportional to the distance r' . Since the distance $r/2$ is half of the radius r , the electric field will be half of the electric field at the surface.

Q37.

Answer: A

Explanation:

The potential at any point on a spherical shell due to its own charge and the charge on other shells is calculated by summing the potentials. For shells at radii a , $2a$, $3a$ with charges $q_A = 4\pi a^2 \sigma$, $q_B = -4\pi(2a)^2 \sigma = -16\pi a^2 \sigma$, and $q_C = 4\pi(3a)^2 \sigma = 36\pi a^2 \sigma$, the potentials calculated at the surfaces result in $V_A = V_C > V_B$.

Q38.

Answer: B

Explanation:

An assembly of charges can be treated as a collection of dipoles. By breaking the $-3q$ charge into two parts ($-q$ and $-2q$), we can form two dipoles: one from $(+q, -q)$ and one from $(+2q, -2q)$. The vector sum of these individual dipole moments gives the total dipole moment of the system.

Q39.

Answer: A

Explanation:

The work done in rotating an electric dipole in a uniform electric field is equal to the change in its potential energy, given by $W = U_f - U_i = -pE \cos(\theta_f) - (-pE \cos(\theta_i))$. For rotation from 60° to 0° (stable equilibrium), we substitute the angles to find the work done.

Q40.

Answer: B

Explanation:

In a uniform electric field, the net force on an electric dipole is always zero because the forces on the two charges are equal and opposite. The torque acting on the dipole is given by the cross product of the dipole moment and the electric field, $\tau = p \times E = pE \sin(\theta)$. At 90 degrees, $\sin(90^\circ) = 1$, resulting in maximum torque pE .

Q41.

Answer: A

Explanation:

According to Gauss's Law, the total flux through a closed surface is $1/\epsilon_0$ times the enclosed charge. A charge at the corner of a cube is shared equally by 8 adjacent cubes. Therefore, only $1/8$ of the total flux q/ϵ_0 passes through the specific cube.

Q42.

Answer: B

Explanation:

For a charged conductor, the entire volume is an equipotential region. Since the electric field inside a conductor is zero, the potential at any point inside (including the center) is equal to the potential at the surface of the conductor.

Q43.

Answer: A

Explanation:

According to Gauss's Law, the total electric flux through a closed surface is equal to q/ϵ_0 . Since the charge is placed at the center of the cube, the flux is distributed symmetrically through all 6 faces of the cube. Therefore, the flux through a single face is exactly one-sixth of the total flux.

Q44.

Answer: C

Explanation:

The torque τ on an electric dipole in a uniform electric field is given by the cross product of the dipole moment and the electric field, $\vec{\tau} = \vec{p} \times \vec{E}$. When the dipole is parallel to the field, the angle between them is 0° . Since $\sin(0^\circ) = 0$, the resulting torque is zero.

Q45.

Answer: B

Explanation:

According to Gauss's law, the total flux through a closed surface is $1/\epsilon_0$ times the enclosed charge. When a charge is placed on a face, we consider a Gaussian surface consisting of two identical cubes joined at that face to enclose the charge. Thus, the total flux through the two-cube system is q/ϵ_0 , and the flux through just one cube is half of that.

Q46.

Answer: B

Explanation:

Meta-directing groups are typically electron-withdrawing groups that deactivate the benzene ring toward electrophilic aromatic substitution. These groups usually have a pi-bond or a positive charge on the atom directly attached to the ring. In the provided list, the meta-directing groups are $-\text{NO}_2$, $-\text{CN}$, $-\text{COR}$, and $-\text{COOH}$.

Q47.

Answer: C

Explanation:

Monochlorination of 2-methylbutane $(\text{CH}_3)_2\text{CHCH}_2\text{CH}_3$ occurs at four distinct carbon positions. Considering the chirality introduced at certain positions, the total number of stereoisomers produced is six.

Q48.

Answer: A

Explanation:

The reaction begins with the protonation of the methylene double bond by HF to form the most stable carbocation intermediate, which is the 3° 1-methylcyclohexyl cation. This cation then acts as an electrophile in an Electrophilic Aromatic Substitution (EAS) reaction with benzene.

Q49.

Answer: C

Explanation:

Under excess bromine and sunlight, ethane undergoes exhaustive free-radical substitution. The total number of derivatives (including positional isomers) across all levels of substitution (mono- to hexa-) is nine.

Q50.

Answer: C

Explanation:

In m-nitrotoluene, the $-\text{CH}_3$ group is o/p directing while the $-\text{NO}_2$ group is meta directing. Both groups direct the incoming electrophile to the same positions on the ring (position 4 and 6). Position 4 is para to methyl but meta to nitro, and position 6 is ortho to methyl but meta to nitro. Substitution at these positions yields products where the halogen is meta or para to the methyl group.

Q51.

Answer: D

Explanation:

Aniline does not undergo Friedel-Crafts reactions effectively. The $-\text{NH}_2$ group is a strong Lewis base and reacts with the Lewis acid catalyst (AlCl_3) used in the reaction to form a salt/complex. This places a positive charge on the nitrogen, making it a highly deactivating group that prevents further substitution.

Q52.

Answer: C

Explanation:

Monochlorination can occur at five constitutionally distinct sites: the methyl group, C_1 , C_2 , C_3 , and C_4 . When considering the stereochemistry (chirality) of the resulting molecules, the total number of isomers is twelve.

Q53.

Answer: B

Q54.

Answer: B

Explanation:

In the presence of H_2SO_4 , the alkene (3-nitrobut-1-ene) is protonated to form a carbocation. The 2° carbocation formed at C_2 is more stable than the 1° carbocation and undergoes electrophilic aromatic substitution on benzene to form the major product.

Q55.

Answer: D

Explanation:

In the presence of sunlight ($h\nu$), bromine reacts with alkenes via a free-radical substitution mechanism rather than addition. The reaction occurs at the allylic position because the intermediate allylic radical is resonance-stabilized.

Q56.

Answer: D

Explanation:

NBS is a specific reagent used for benzylic or allylic bromination. In ethylbenzene, the benzylic position (the carbon attached directly to the ring) is the most reactive toward radical substitution because the resulting radical is resonance-stabilized by the benzene ring.

Q57.

Answer: D

Explanation:

In the presence of the Lewis acid catalyst $FeCl_3$, the reaction is an electrophilic aromatic substitution. The methyl group in toluene is an activating and ortho/para-directing group, leading to a mixture of o-chlorotoluene and p-chlorotoluene as major products.

Q58.

Answer: D

Explanation:

Bromination of alkanes follows a free-radical substitution mechanism. The stability of the intermediate free radical determines the major product, following the order: *tertiary* (3°) > *secondary* (2°) > *primary* (1°). Bromine is highly selective and preferentially replaces the hydrogen on the most stable carbon atom, which in 2-methylbutane is the tertiary carbon.

Q59.

Answer: C

Explanation:

The number of monochlorinated derivatives formed depends on the number of sets of equivalent hydrogen atoms in the molecule. For an isomer to yield only two products, it must have high symmetry such that it only possesses two distinct types of hydrogens. Among the hexanes, 2,3-dimethylbutane meets this criteria.

Q60.

Answer: C

Explanation:

An alkane produces only one monochlorinated derivative if all the hydrogen atoms in the molecule are chemically equivalent. In neopentane, all twelve hydrogen atoms are primary and attached to methyl groups that are symmetrically bonded to a single central carbon atom.

Q61.

Answer: B

Q62.

Answer: A

Q63.

Answer: D

Q64.

Answer: D

Q65.

Answer: C

Q66.

Answer: B

Explanation:

Reaction with bromine in the presence of light ($h\nu$) follows a free-radical substitution mechanism rather than addition. The reaction occurs at the allylic position because the intermediate radical is resonance-stabilized. The secondary allylic radical at C_3 is the most stable intermediate, leading to the major product.

Q67.

Answer: A

Q68.

Answer: B

Explanation:

Bromination of alkanes proceeds through a free-radical substitution mechanism. The bromine radical ($Br^\bullet$) is highly selective and preferentially abstracts a hydrogen atom that leads to the formation of the most stable radical intermediate. In 2-deutero-3-methylbutane, the tertiary (3°) carbon atom (the one bonded to the methyl group) provides the most stable radical site. Therefore, the bromine atom substitutes the tertiary hydrogen to form the major product.

Q69.

Answer: C

Explanation:

To find the total number of monochlorinated isomers for 3-methylpentane, we identify all unique substitution sites and account for any chirality introduced during the reaction:

- C_1/C_5 substitution: Produces 1-chloro-3-methylpentane. This creates a chiral center at C_3 , resulting in 2 enantiomers.
- C_2/C_4 substitution: Produces 2-chloro-3-methylpentane. This creates two chiral centers (C_2 and C_3), resulting in 4 stereoisomers.
- C_3 substitution: Produces 3-chloro-3-methylpentane. This molecule is achiral, giving 1 isomer.
- Methyl group substitution: Produces 1-chloro-2-ethylbutane. This molecule is also achiral, giving 1 isomer.

The total is $2 + 4 + 1 + 1 = 8$.

Q70.

Answer: B

Q71.

Answer: B

Explanation:

In neopentane, all hydrogen atoms are chemically equivalent. Because of this symmetry, replacing any hydrogen atom with a chlorine atom results in the exact same product molecule.

Q72.

Answer: D

Q73.

Answer: C

Explanation:

In m-Xylene, the methyl groups are ortho/para directing. While they activate positions 2, 4, and 6, position 2 is located between the two methyl groups and is highly sterically hindered. Therefore, substitution predominantly occurs at the less crowded 4 and 6 positions.

Q74.

Answer: A

Explanation:

Friedel-Crafts reactions require an electron-rich aromatic ring. Nitrobenzene contains a nitro ($-NO_2$) group, which is a powerful electron-withdrawing group that strongly deactivates the benzene ring, making it resistant to electrophilic substitution.

Q75.

Answer: C

Explanation:

The reaction conditions dictate the site of substitution. With a Lewis acid catalyst ($FeCl_3$), electrophilic substitution occurs on the ring. In the presence of light, free radical substitution occurs on the methyl side-chain.

Q76.

Answer: D

Explanation:

This is the standard Friedel-Crafts alkylation of benzene. The methyl group from methyl chloride (CH_3Cl) replaces a hydrogen atom on the benzene ring to produce toluene.

Q77.

Answer: C

Explanation:

Ethylbenzene is produced commercially and in the lab by the reaction of benzene with ethene ($H_2C=CH_2$) using $AlCl_3$ and HCl as catalysts.

Q78.

Answer: A

Explanation:

Free-radical substitution occurs when energy (heat or light) causes homolytic cleavage of a bond to form radicals. The reaction of toluene with chlorine while boiling involves the formation of a stable benzyl free radical intermediate.

Q79.

Answer: D

Explanation:

The rate of electrophilic substitution is determined by the electron density of the ring. Aniline has a strongly activating $-NH_2$ group that increases density, while nitrobenzene has a strongly deactivating $-NO_2$ group that decreases it.

Q80.

Answer: A

Explanation:

Friedel-Crafts alkylation involves reacting benzene with an alkyl halide. To prepare toluene (methylbenzene), the required halide is methyl chloride (CH_3Cl).

Q81.

Answer: A

Explanation:

Friedel-Crafts alkylation specifically refers to the introduction of an alkyl group into an aromatic ring using an alkyl halide and a Lewis acid catalyst.

Q82.

Answer: A

Explanation:

Electrophiles target electron-rich areas. Substituents like $-OH$ in phenol are strongly activating because they donate electrons into the benzene ring via resonance, making it highly susceptible to electrophilic attack.

Q83.

Answer: A

Explanation:

Arenes (aromatic hydrocarbons) are characterized by their unusual stability due to the delocalization of π -electrons and resonance. Because addition reactions would destroy this aromatic stability, arenes predominantly undergo substitution reactions instead.

Q84.

Answer: A

Q85.

Answer: C

Q86.

Answer: C

Explanation:

During nitration, a mixture of concentrated sulphuric and nitric acids is used. The sulphuric acid protonates the nitric acid, eventually leading to the formation of the nitronium ion (NO_2^+), which is the active electrophile.

Q87.

Answer: A

Explanation:

This problem involves the free-radical monochlorination of 2-methylbutane (isopentane). The value N represents the total number of stereoisomers produced, including enantiomers. The value M represents the number of distinct fractions obtained through fractional distillation. Since enantiomers possess identical boiling points, they cannot be separated by fractional distillation and will come off as a single fraction together.

Q88.

Answer: A

Q89.

Answer: C

Q90.

Answer: D

Explanation:

The reactivity of hydrogen atoms in alkanes during free-radical substitution follows the stability of the free radical intermediate that remains after the hydrogen is removed. Since tertiary radicals are the most stable, tertiary hydrogens are the most reactive

Q91.

Answer: A

Q92.

Answer: A

Q93.

Answer: A

Q94.

Answer: A

Q95.

Answer: C

Q96.

Answer: B

Q97.

Answer: B

Q98.

Answer: B

Q99.

Answer: B

Q100.

Answer: A

Q101.

Answer: A

Q102.

Answer: B

Q103.

Answer: B

Q104.

Answer: C

Q105.

Answer: D

Q106.

Answer: D

Q107.

Answer: C

Q108.

Answer: C

Q109.

Answer: C

Q110.

Answer: D

Q111.

Answer: A

Q112.

Answer: A

Q113.

Answer: D

Q114.

Answer: D

Q115.

Answer: A

Q116.

Answer: B

Q117.

Answer: B

Q118.

Answer: C

Q119.

Answer: A

Q120.

Answer: C

Q121.

Answer: D

Q122.
Answer: A

Q123.
Answer: B

Q124.
Answer: B

Q125.
Answer: B

Q126.
Answer: D

Q127.
Answer: C

Q128.
Answer: B

Q129.
Answer: A

Q130.
Answer: D

Q131.
Answer: B

Q132.
Answer: B

Q133.
Answer: A

Q134.
Answer: D

Q135.
Answer: C

Q136.
Answer: C

Q137.
Answer: B

Q138.
Answer: A

Q139.
Answer: A

Q140.
Answer: B

Q141.
Answer: D

Q142.
Answer: B

Q143.
Answer: C

Q144.
Answer: B

Q145.
Answer: C

Q146.
Answer: A

Q147.
Answer: A

Q148.
Answer: D

Q149.
Answer: A

Q150.
Answer: A

Q151.
Answer: A

Q152.
Answer: A

Q153.
Answer: C

Q154.
Answer: D

Q155.
Answer: C

Q156.
Answer: C

Q157.
Answer: C

Q158.
Answer: C

Q159.
Answer: D

Q160.
Answer: A

Q161.
Answer: B

Q162.
Answer: D

Q163.
Answer: D

Q164.
Answer: D

Q165.
Answer: C

Q166.
Answer: A

Q167.
Answer: D

Q168.
Answer: D

Q169.
Answer: D

Q170.
Answer: C

Q171.
Answer: D

Q172.
Answer: A

Q173.
Answer: D

Q174.
Answer: A

Q175.
Answer: A

Q176.
Answer: D

Q177.
Answer: B

Q178.
Answer: C

Q179.
Answer: B

Q180.
Answer: D