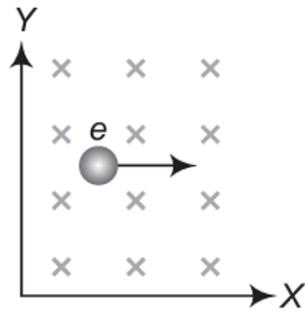


11. In the given figure, the electron enters into the magnetic



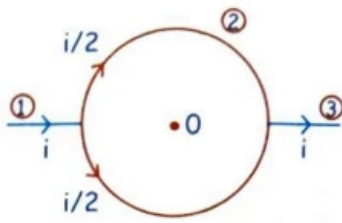
field. It will deflect in:

- A) Positive Y-direction B) Negative Y-direction
C) Positive X-direction D) Negative X-direction

12. A proton, a deuteron and an α -particle, having the same kinetic energy, are moving in circular trajectories in a constant magnetic field. If r_p , r_d and r_α denote, respectively the radii of the trajectories of these particles, then

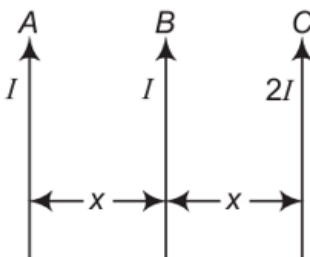
- A) $r_\alpha = r_p < r_d$ B) $r_\alpha > r_d > r_p$
C) $r_\alpha = r_d > r_p$ D) $r_p = r_d = r_\alpha$

13. From the image given below, find the total magnetic field vector $\vec{B}_O$ at the center O of a circular loop of radius R where current i enters at one point, splits equally into two semi-circular paths carrying current $i/2$ each, and exits at the diametrically opposite point.



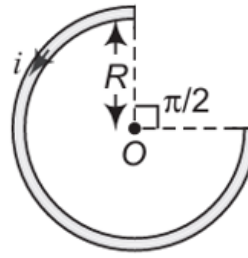
- A) 0 B) $\frac{Ki}{R} \pi \otimes$
C) $\frac{Ki}{2R} \pi \odot$ D) $\frac{2Ki}{R} \pi$

14. A, B and C are parallel conductors of equal length carrying currents I, I and 2I respectively. Distance between A and B is x . Distance between B and C is also x . F_1 is the force exerted by B on A. F_2 is the force exerted by C on A. Choose the correct answer.



- A) $F_1 = 2F_2$ B) $F_2 = 2F_1$
C) $F_1 = F_2$ D) $F_1 = -F_2$

15. A current i ampere flows in a circular arc of wire whose radius is R , which subtend an angle $3\pi/2$ radian at its centre. The magnetic induction B at the centre is



- A) $\frac{\mu_0 i}{R}$ B) $\frac{\mu_0 i}{2R}$
C) $\frac{2\mu_0 i}{R}$ D) $\frac{3\mu_0 i}{8R}$

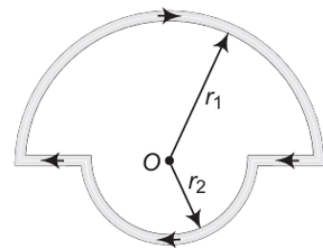
16. The strength of the magnetic field at a distance r near a long straight current carrying wire is B . The field at a distance $r/2$ will be

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

17. A current of 0.1 A circulates around a coil of 100 turns and having a radius equal to 5 cm. The magnetic field set up at the centre of the coil is ($\mu_0 = 4\pi \times 10^{-7}$ Wb/A-m)

- A) $4\pi \times 10^{-5}$ T B) $8\pi \times 10^{-5}$ T
C) 4×10^{-5} T D) 2×10^{-5} T

18. In the figure shown there are two semicircles of radii r_1 and r_2 which a current i is flowing. The magnetic induction at the



centre O will be

- A) $\frac{\mu_0 i (r_1 + r_2)}{4}$ B) $\frac{\mu_0 i (r_1 - r_2)}{4}$
C) $\frac{\mu_0 i}{4} \left(\frac{1}{r_1} + \frac{1}{r_2} \right)$ D) $\frac{\mu_0 i}{4} \left(\frac{1}{r_2} - \frac{1}{r_1} \right)$

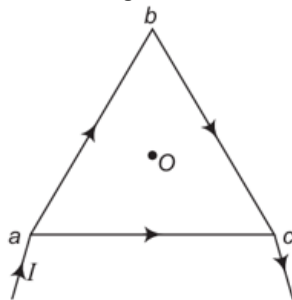
19. An arc of a circle of radius R subtends an angle $\pi/2$ at the centre. It carries a current i . The magnetic field at the centre will be

- A) $\frac{\mu_0 i}{2R}$ B) $\frac{\mu_0 i}{8R}$
C) $\frac{\mu_0 i}{4R}$ D) $\frac{2\mu_0 i}{5R}$

20. A long wire carries a steady current. It is bent into a circle of one turn and the magnetic field at the centre of the coil is B . It is then bent into a circular loop of n turns. The magnetic field at the centre of the coil will be

- A) nB B) $n^2 B$
C) $3nB$ D) $n^3 B$

21. An equilateral triangle of side length l is formed from a piece of wire of uniform resistance. The current I is fed as shown in the figure. Then, the magnitude of the magnetic field at its



centre O is

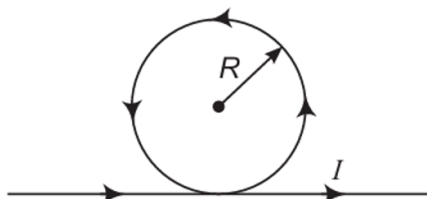
- A) $\frac{3\mu_0 I}{2\pi l}$ B) $\frac{3\sqrt{3}\mu_0 I}{2\pi l}$
C) $\frac{\mu_0 I}{2\pi l}$ D) zero

22. A straight thin conductor is bent as shown in the adjoining figure. It carries a current i ampere. The radius of the semicircular arc is r metre. The magnetic induction at the centre of semicircular arc is



- A) $\frac{\mu_0 i}{4\pi r}$ B) $\frac{\mu_0 i}{4r}$
C) $\frac{\mu_0 i}{8\pi r}$ D) zero

23. An infinitely long conductor is bent into a circle as shown in figure. It carries a current I ampere and the radius of loop is R metre. The magnetic induction at the centre of loop is

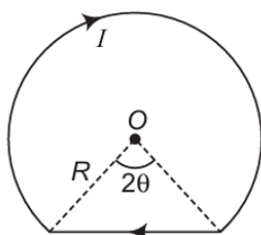


- A) $\frac{\mu_0 2I}{4\pi R}(\pi + 1)$ B) $\frac{\mu_0 2I}{4\pi R}(\pi - 1)$
C) $\frac{\mu_0 I}{8\pi R}(\pi + 1)$ D) zero

24. A circular current carrying coil has a radius R . The distance from the centre of the coil on the axis of the coil, where the magnetic induction is $1/8$ th of its value at the centre of coil is

- A) $\sqrt{3}R$ B) $R/\sqrt{3}$
C) $(2/3)R$ D) $R/2\sqrt{3}$

25. A current I flows through a closed loop shown in figure. The



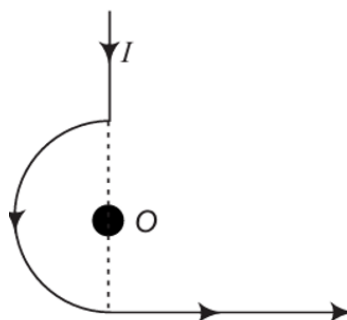
magnetic field at the centre O is

- A) $\frac{\mu_0 I}{2\pi R}(\pi - \theta + \tan \theta)$ B) $\frac{\mu_0 I}{2\pi R}(\pi - \theta + \sin \theta)$
C) $\frac{\mu_0 I}{2\pi R}(\pi + \sin \theta)$ D) None of these

26. Two identical coils carrying equal currents, have a common centre, and their planes are at right angles to each other. Find the ratio of the magnitudes of the resultant magnetic field at the centre and the field due to one coil alone.

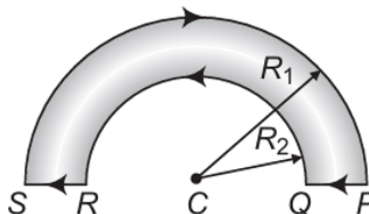
- A) 2:1 B) 1:1
C) $1 : \sqrt{2}$ D) $\sqrt{2} : 1$

27. Magnetic field induction at the point O due to current flowing in an infinite wire shaped as shown in the figure is



- A) $\frac{\mu_0 I}{4\pi R}$ B) $\frac{\mu_0 I}{4R} - \frac{\mu_0 I}{4\pi R}$
C) $\frac{\mu_0 I}{4R} + \frac{\mu_0 I}{2\pi R}$ D) $\frac{\mu_0 I}{4R} + \frac{\mu_0 I}{4\pi R}$

28. The wire loop PQRSP formed by joining two semicircular wires of radii R_1 and R_2 carries a current I as shown. The magnitude of magnetic induction at the centre C is:

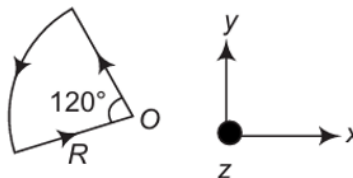


- A) $\frac{\mu_0 I}{4} \left(\frac{1}{R_1} - \frac{1}{R_2} \right)$ B) $\frac{\mu_0 I}{4} \left(\frac{1}{R_2} - \frac{1}{R_1} \right)$
C) $\mu_0 I \left(\frac{1}{R_1} - \frac{1}{R_2} \right)$ D) $\frac{\mu_0 I}{4} \left(\frac{1}{R_1} \right)$

29. The magnetic field at the centre of a circular coil of radius r carrying current I is B_1 . The field at the centre of another coil of radius $2r$ carrying same current I is B_2 . The ratio B_1/B_2 is

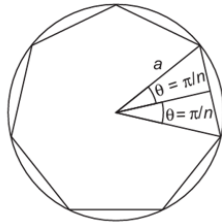
- A) $1/2$ B) 1
C) 2 D) 4

30. The magnetic field B at O due to current carrying loop placed in the $x - y$ plane as shown in the figure is:



- A) $\frac{\mu_0 I}{R} \hat{k}$ B) $\frac{\mu_0 I}{6R} \hat{k}$
C) $\frac{\mu_0 I}{6R} (-\hat{k})$ D) zero

31. A wire bent in the form of a regular polygon of n sides, is inscribed in a circle of radius a . If i ampere is the current flowing in the wire, then the magnetic flux density (magnetic



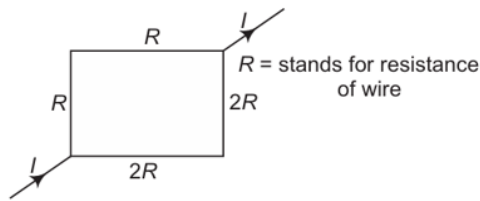
field) at the centre of the circle is

- A) $\frac{\mu_0 i}{2\pi a} \tan\left(\frac{\pi}{n}\right)$ B) $\frac{\mu_0 n i}{2\pi a} \tan\left(\frac{\pi}{n}\right)$
C) $\frac{2}{\pi} \frac{m i}{a} \mu_0 \tan\left(\frac{\pi}{n}\right)$ D) $\frac{n i}{2a} \mu_0 \tan\left(\frac{\pi}{n}\right)$

32. A square frame of side 1 m carries a current I , produces a magnetic field B at its centre. The same current is passed through a circular coil having the same perimeter as the square. The magnetic field at the centre of the circular coil is B' . The ratio B/B' is:

- A) $\frac{8\sqrt{2}}{\pi^2}$ B) $\frac{8}{\sqrt{2}\pi^2}$
C) $\frac{16}{\pi^2}$ D) $\frac{16}{2\sqrt{2}\pi^2}$

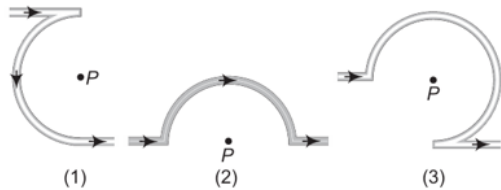
33. The magnetic field at the centre of square of side a is (given a square loop where current I enters one corner and leaves the opposite corner, with sides having resistances $R, R, 2R,$



$2R$):

- A) $\frac{2\sqrt{2}\mu_0 I}{\pi a}$ B) $\frac{2\sqrt{2}\mu_0 I}{3\pi a}$
C) $\frac{2\sqrt{2}\mu_0 I}{3a}$ D) zero

34. Figure here shows three cases : in all cases the circular path has radius r and straight ones are infinitely long. For same current the magnetic field at the centre P in cases 1, 2, 3 have the ratio



- A) $\left(-\frac{\pi}{2}\right) : \left(\frac{\pi}{2}\right) : \left(\frac{3\pi}{4} - \frac{1}{2}\right)$ B) $\left(-\frac{\pi}{2} + 1\right) : \left(\frac{\pi}{2} + 1\right) : \left(\frac{3\pi}{4} + \frac{1}{2}\right)$
C) $-\frac{\pi}{2} : \frac{\pi}{2} : 3\frac{\pi}{4}$ D) $\left(-\frac{\pi}{2} - 1\right) : \left(\frac{\pi}{2} - \frac{1}{4}\right) : \left(\frac{3\pi}{4} + \frac{1}{2}\right)$

35. Consider a planar wire loop having a square shape with side length a . If a steady current I flows through the wire, the magnitude of magnetic field at the centre of the loop is

- A) $\frac{\sqrt{2}\mu_0 I}{\pi a}$ B) $\frac{2\sqrt{2}\mu_0 I}{\pi a}$
C) $\frac{\mu_0 I}{\sqrt{2}\pi a}$ D) $\frac{4\mu_0 I}{\pi a}$

36. A charged particle of mass m and charge q moves in a circular path of radius r perpendicular to a uniform magnetic field of strength B . The time period of revolution T is

- A) $\frac{2\pi m}{qB}$ B) $\frac{2\pi q}{mB}$
C) $\frac{qB}{2\pi m}$ D) $\frac{mB}{2\pi q}$

37. An electron and a proton with equal kinetic energy enter perpendicularly into a uniform magnetic field, then

- A) the path of proton shall be more curved than that of electron B) the path of proton shall be less curved than that of electron
C) both are equally curved D) path of both will be straight line

38. A proton, a deuteron and an α -particle, having the same momentum, enter perpendicularly into a uniform magnetic field. If r_p, r_d and r_α denote, respectively the radii of the trajectories of these particles, then

- A) $r_p = r_d > r_\alpha$ B) $r_p < r_d < r_\alpha$
C) $r_p = r_d = r_\alpha$ D) $r_p > r_d > r_\alpha$

39. A wire of length 4 m carrying a current of 1 A is bent to form a circle. The magnetic moment of the coil is (in A m^2):

- A) 4π B) $2/\pi$
C) $4/\pi$ D) $1/\pi$

40. The magnetic field at a distance d from a long straight current carrying wire is B_0 . The magnetic field at a distance $2d$ will be

- A) $B_0/2$ B) $B_0/4$
C) $2B_0$ D) $4B_0$

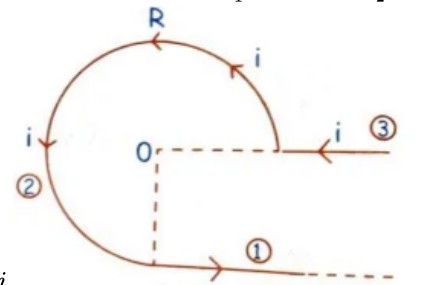
41. A current of 0.1 A circulates around a coil of 100 turns and having a radius equal to 10 cm. The magnetic field set up at the centre of the coil is ($\mu_0 = 4\pi \times 10^{-7} \text{ Wb/A-m}$):

- A) $2\pi \times 10^{-5} \text{ T}$ B) $4\pi \times 10^{-5} \text{ T}$
C) $2 \times 10^{-5} \text{ T}$ D) $4 \times 10^{-5} \text{ T}$

42. An arc of a circle of radius R subtends an angle $\pi/3$ at the centre. It carries a current i . The magnetic field at the centre will be

- A) $\frac{\mu_0 i}{6R}$ B) $\frac{\mu_0 i}{12R}$
C) $\frac{\mu_0 i}{4R}$ D) $\frac{\mu_0 i}{3R}$

43. From the image given below, find the total magnetic field vector $\vec{B}_O$ at point O due to the current-carrying wire configuration consisting of a circular arc of radius R subtending an angle of $\frac{3\pi}{2}$ radians at center O, a semi-infinite straight wire whose line of action passes through O, and a semi-infinite straight wire running parallel to the horizontal at a distance R from O with $\theta_1 = 90^\circ$ and $\theta_2 = 0^\circ$,



carrying current i

- A) $\frac{Ki}{R} \left(\frac{3\pi}{2} + 1\right) \odot$ B) $\frac{Ki}{R} \left(\frac{3\pi}{2} - 1\right) \otimes$
C) $\frac{Ki}{R} \left(\frac{\pi}{2} + 1\right) \odot$ D) $\frac{2Ki}{R} \left(\frac{3\pi}{2} + 1\right) \otimes$

44. A circular current carrying coil has a radius R . The distance from the centre of the coil on the axis of the coil, where the magnetic induction is $1/(5\sqrt{5})$ of its value at the centre of coil is

- A) R B) $2R$
C) $\sqrt{2}R$ D) $3R$

A) $1/4$ **B) $1/2$**
C) 2 **D) 4**

Chemistry

46. What is the product when acetylene reacts with hypochlorous acid?

A) CH_3COCl B) ClCH_2CHO
C) Cl_2CHCHO D) ClCH_2COOH

47. Which of these will not react with acetylene?

A) Dil. NaOH **B) Ammoniacal AgNO_3**
C) Na in liq. NH_3 **D) HCl**

48. Butene-1 may be converted to butane by reaction with

A) Sn - HCl **B) Zn - Hg**
C) Pd/H₂ **D) Zn - HCl**

49. Reaction of one molecule of HBr with one molecule of 1,3-butadiene at 40°C gives predominantly

A) 1-bromo-2-butene under kinetically controlled conditions

B) 3-bromobutene under thermodynamically controlled conditions

C) 1-bromo-2-butene under thermodynamically controlled conditions

D) 3-bromobutene under kinetically controlled conditions

50. Which one of the following has minimum boiling point?

A) 1-Butene **B) 1-Butyne**

C) n-Butane **D) Isobutane**

51. Which of the following reactions will yield 2,2-dibromopropane?

A) $CH_3 - CH = CH_2 + HBr \rightarrow$ **B)** $CH_3 - C \equiv CH + 2HBr \rightarrow$
C) $CH_3CH = CHBr + HBr \rightarrow$ **D)** $CH = CH + 2HBr \rightarrow$

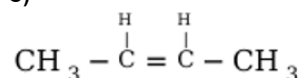
52. The treatment of CH_3MgX with $CH_3C \equiv C-H$ produces

A) CH₃-CH=CH₂

B) CH₃C≡C-CH₃

C)

D) CH₄



53. The hydrocarbon which can react with sodium in liquid ammonia is

A) $CH_3CH_2CH_2C \equiv CCH_2CH_2CH_3$ **B)** $CH_3CH_2C \equiv CH$
C) $C_2H_5CH=CHCH_3$ **D)** $CH_3CH_2C \equiv CCH_2CH_3$

54. In the following sequence of reactions, the alkene affords the compound B: $\text{CH}_3\text{-CH=CH-CH}_3 \xrightarrow{\text{O}_3} \text{A} \xrightarrow[\text{Zn}]{\text{H}_2\text{O}} \text{B}$ The compound B is

A) $\text{CH}_3\text{CH}_2\text{CHO}$ **B)** CH_3COCH_3
C) $\text{CH}_3\text{CH}_2\text{COCH}_3$ **D)** CH_3CHO

55. One mole of a symmetrical alkene on ozonolysis gives two moles of an aldehyde having a molecular mass of 44 u. The alkene is

A) Propene **B) 1-Butene**
C) 2-Butene **D) Ethene**

56. Ozonolysis of an organic compound 'A' produces acetone and propionaldehyde in equimolar mixture. Identify 'A' from the following compounds:

A) 1-Pentene **B) 2-Pentene**
C) 2-Methyl-2-pentene **D) 2-Methyl-1-pentene**

57. The hydration of propyne results in formation of

A) Acetone
B) Propanol-1
C) Propene
D) Propanal

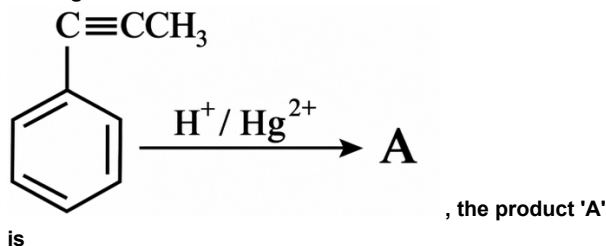
58. The gas liberated by the electrolysis of dipotassium succinate solution is:

A) Ethane **B) Ethyne**
C) Ethene **D) Propene**

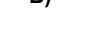
59. 2-Hexyne gives trans-2-hexene on treatment with:

A) Pt/H_2 **B) Li/NH_3**
C) $Pd/BaSO_4$ **D) $LiAlH_4$**

60. In the given reaction



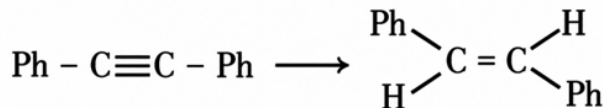
A) 

B) 

C) 

D) 

61. The reagent needed for the given conversion is



A) Cat .hydrogenation
B) H_2 /Lindlar cat.
C) Li/NH_3
D) $LiAlH_4$

62. In the presence of peroxide, HCl and HI do not give anti-Markownikoff's addition of alkenes because

A) One of the steps is endothermic in HCl and HI

B) Both HCl and HI are strong acids

C) HCl is oxidizing and the HI is reducing

D) All the steps are exothermic in HCl and HI

63. In the hydroboration - oxidation reaction of propene with diborane, H_2O_2 and NaOH, the organic compound formed is

A) CH_3CH_2OH **B)** $CH_3CHOHCH_3$
C) $CH_3CH_2CH_2OH$ **D)** $(CH_3)_3COH$

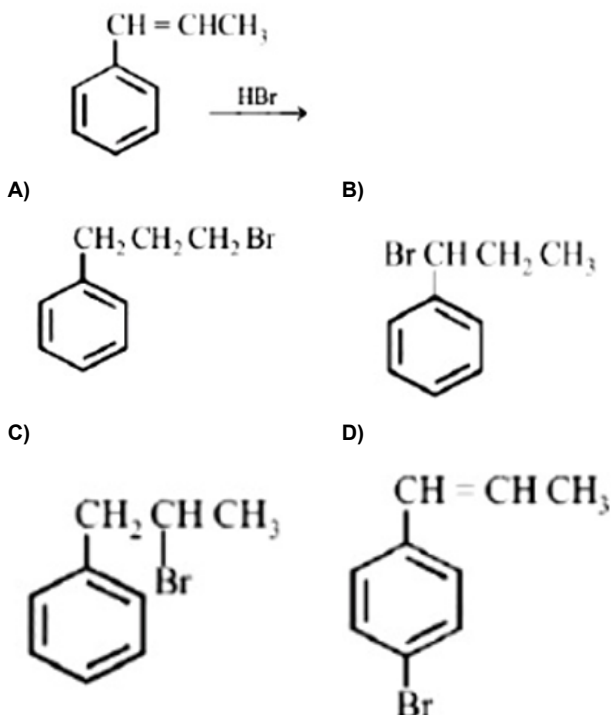
64. 3-Methyl-pent-2-ene on reaction with HBr in presence of peroxide forms an addition product. The number of possible stereoisomers for the product is:

- A) Six
B) Zero
C) Two
D) Four

65. When 2-butyne is treated with $\bar{H}_2$ / Lindlar's catalyst, compound X is produced as the major product, and when treated with $Na/liq. NH_3$, it produces Y as the major product. Which of the following statements is correct?

- A) Y will have higher dipole moment and higher boiling point than X
B) Y will have higher dipole moment and lower boiling point than X
C) X will have lower dipole moment and lower boiling point than Y
D) X will have higher dipole moment and higher boiling point than Y

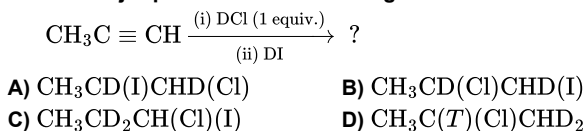
66. The major product of the following reaction is:



67. The trans-alkenes are formed by the reduction of alkynes with

- A) $H_2 - Pd/C, BaSO_4$
B) $NaBH_4$
C) $Na/liq. NH_3$
D) $Sn - HCl$

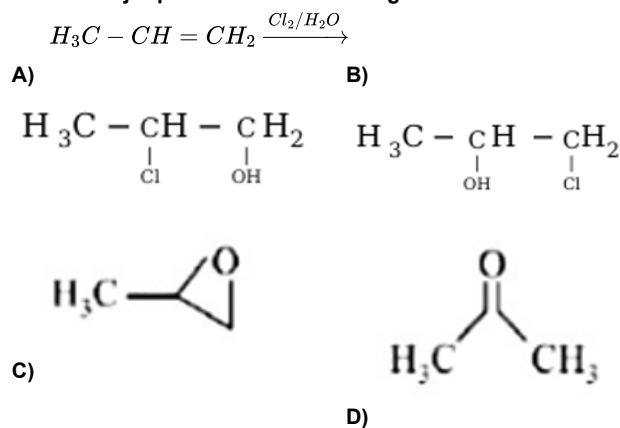
68. The major product of the following reaction is:



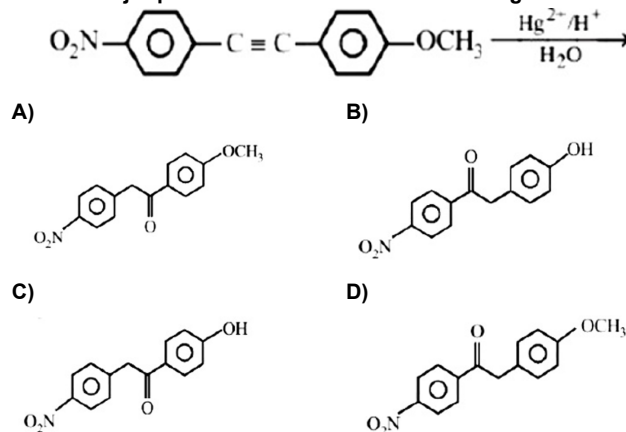
69. But-2-ene on reaction with alkaline $KMnO_4$ at elevated temperature followed by acidification will give:

- A) CC(O)CC(O)C
B) One molecule of CH_3CHO and one molecule of CH_3COOH
C) 2 molecules of CH_2COOH
D) 2 molecules of CH_3^0CHO

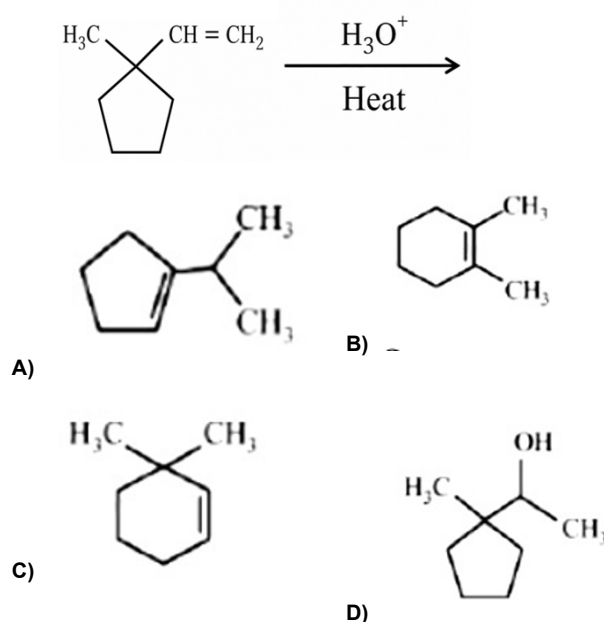
70. The major product of the following addition reaction is:



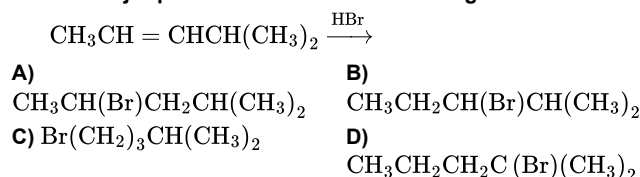
71. The major product obtained from the following reaction is:



72. The major product in the following reaction is:



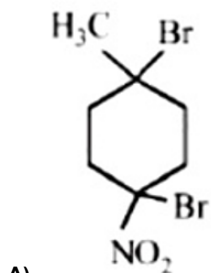
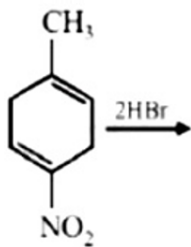
73. The major product formed in the following reaction is:



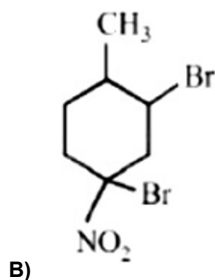
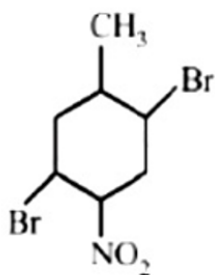
74. Which of the following compounds shows geometrical isomerism?

- A) 2-methylpent-2-ene
B) 4-methylpent-2-ene
C) 4-methylpent-1-ene
D) 2-methylpent-1-ene

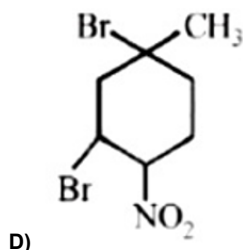
75. The major product of the following reaction is :



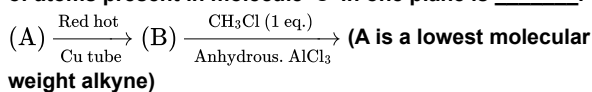
C)



D)



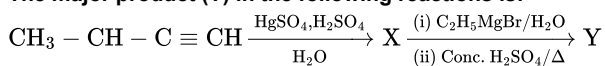
76. In the following sequence of reactions the maximum number of atoms present in molecule 'C' in one plane is _____.



A) 13
C) 15

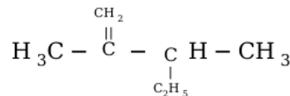
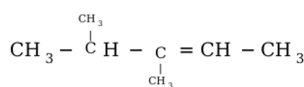
B) 98
D) 87

77. The major product (Y) in the following reactions is:



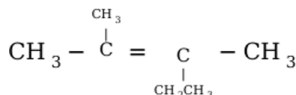
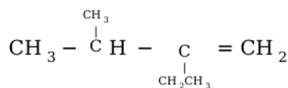
A)

B)

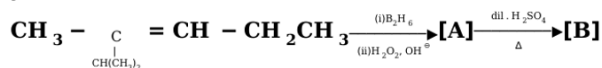


C)

D)

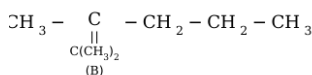
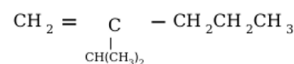


78. The major product [B] in the following sequence of reactions is:



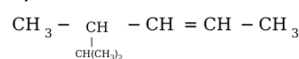
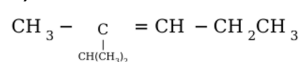
A)

B)



C)

D)



79. The correct order of heat of combustion for the following

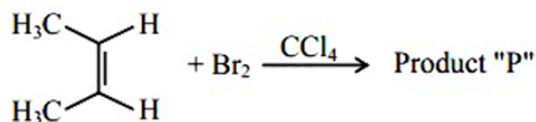


alkadienes is:

A) (A) < (B) < (C)
C) (C) < (B) < (A)

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

80.

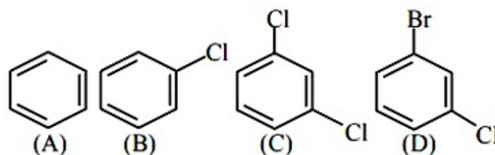


Consider the above chemical reaction. The total number of stereoisomers possible for Product 'P' is _____.

A) 2
C) 7

B) 4
D) 8

81. The correct decreasing order of densities of the following compounds is:



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

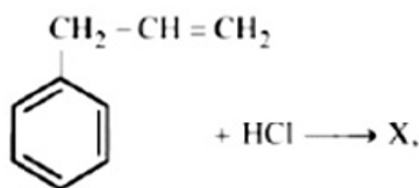
B) (C) > (D) > (A) > (B)
D) (A) > (B) > (C) > (D)

82. Which one of the following alkenes when treated with HCl yields majorly an anti-Markovnikov product?

A) CH₃O - CH = CH₂
C) H₂N - CH = CH₂

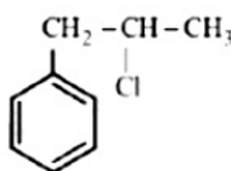
B) Cl - CH = CH₂
D) F₃C - CH = CH₂

83.

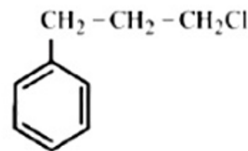


X is

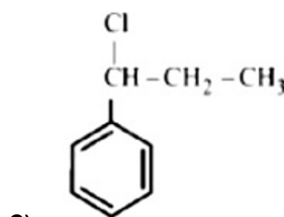
A)



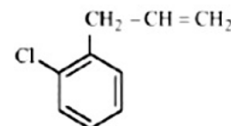
B)



D)



C)



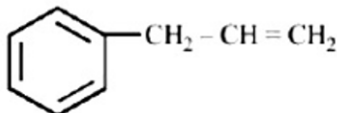
84. The addition of HI in the presence of peroxide catalyst does not follow anti-Markovnikov's rule because:

- A) HI is a strong reducing agent. B) H-I bond is too strong to be broken homolytically.
C) I atom combines with H atom to give back HI. D) Iodine atom is not reactive enough to add across a double bond.

85. Which one of the following class of compounds is obtained by polymerization of acetylene?

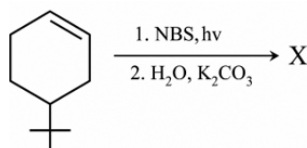
- A) Poly-yne B) Poly-ene
C) Poly-ester D) Poly-amine

86. On mercuration-demercuration produces the major product :



- A) B)
C) D)

87. The product of the reaction given below is:

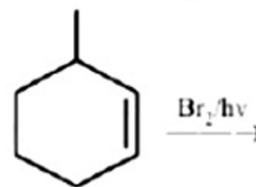


- A) B)
C) D)

88. The reaction of propene with HOCl ($Cl_2 + H_2O$) proceeds through the intermediate:

- A) $CH_3 - CH(OH) - CH_2^+$ B) $CH_3 - CHCl - CH_2^+$
C) $CH_3 - CH^+ - CH_2 - OH$ D) $CH_3 - CH^+ - CH_2 - Cl$

89. The major product of the following reaction is:



- A) B)
C) D)

90. Among the following compounds, geometrical isomerism is exhibited by:

- A) B)
C) D)

Botany

91. A molecule that can act as a genetic material must fulfill the following criteria, except:

- A) It should be able to generate its replica (Replication). B) It should be chemically and structurally unstable.
C) It should provide the scope for slow changes (Mutation) that are required for evolution. D) It should be able to express itself in the form of 'Mendelian Characters'.

92. RNA is chemically more reactive and structurally less stable than DNA because:

- A) RNA has a 2'-OH group present on every nucleotide's ribose sugar. B) RNA is known to have catalytic properties (ribozymes).
C) RNA contains uracil instead of the more stable thymine. D) All of the above.

93. Which of the following statements correctly differentiates the functional roles of DNA and RNA?

- A) DNA is better for transmission of genetic information, while RNA is better for storage.
B) DNA is better for storage of genetic information, while RNA is better for transmission.
C) Both store and transmit genetic information with equal chemical efficiency.
D) DNA cannot mutate, whereas RNA can mutate at a fast rate.

94. Both DNA and RNA share which of the following structural similarities?

- A) They contain identical purines and pyrimidines.
B) They are polymers of nucleotides.
C) They contain the exact same pentose sugar backbone.
D) They natively exist as double-stranded helices.

95. The presence of thymine in DNA instead of uracil in RNA confers stability because:

- A) Thymine lacks an oxygen molecule compared to uracil.
B) The methyl group at the C-5 position of thymine adds structural integrity and resistance to mutations.
C) Thymine allows DNA to change into a single-stranded conformation easily.
D) Uracil completely prevents any hydrogen bonding.

96. Viruses having an RNA genome and a shorter lifespan mutate and evolve at a much faster rate. This is primarily because:

- A) RNA can replicate independently of host cells.
B) RNA being unstable mutates at a faster rate.
C) RNA has a double-stranded shield.
D) Viral proteins actively break down host DNA.

97. According to the 'RNA World' hypothesis, which property of RNA supports the theory that it was the first genetic material to evolve?

- A) Its ability to form a perfect double helix.
B) Its capacity to act both as a genetic information carrier and a catalyst (enzyme).
C) Its extreme chemical stability in high temperatures.
D) Its resistance to ribonuclease enzymes.

98. Which of the following statements provides the strongest evidence that RNA was the first genetic material on Earth?

- A) RNA is double-stranded in most primitive organisms.
B) Essential life processes like translation, splicing, and metabolism evolved around RNA.
C) RNA is highly stable and does not mutate easily under harsh primitive conditions.
D) RNA synthesized proteins directly without needing any enzymes.

99. Which molecule serves as the "adapter molecule" that bridges the gap between the genetic code in mRNA and specific amino acids during protein synthesis?

- A) mRNA
B) rRNA
C) tRNA
D) snRNA

100.

What are the characteristic secondary (2D) and tertiary (3D) shapes of a tRNA molecule, respectively?

- A) Cloverleaf-shaped, L-shaped
B) L-shaped, Cloverleaf-shaped
C) Double helix, Hairpin loop
D) Globular, Linear

101.

At which specific location on the tRNA molecule does the amino acid become covalently attached?

- A) 5'-end
B) Anticodon loop
C) DHU loop
D) 3'-end

102.

In eukaryotic cells, which specific enzyme is responsible for the transcription of transfer RNA (tRNA) molecules?

- A) RNA polymerase I
B) RNA polymerase II
C) RNA polymerase III
D) DNA polymerase III

103.

If an mRNA codon sequence reads 5'-AUG-3', what will be the correct sequence of the corresponding tRNA anticodon read from 5' to 3'?

- A) 5'-UAC-3'
B) 5'-CAU-3'
C) 5'-AUG-3'
D) 5'-GUA-3'

104.

Which molecule serves as the "adapter molecule" that bridges the gap between the genetic code in mRNA and specific amino acids during protein synthesis?

- A) mRNA
B) rRNA
C) tRNA
D) snRNA

105.

What are the characteristic secondary (2D) and tertiary (3D) shapes of a tRNA molecule, respectively?

- A) Cloverleaf-shaped, L-shaped
B) L-shaped, Cloverleaf-shaped
C) Double helix, Hairpin loop
D) Globular, Linear

106.

At which specific location on the tRNA molecule does the amino acid become covalently attached?

- A) 5'-end
B) Anticodon loop
C) DHU loop
D) 3'-end

107.

In the /ac operon, the I gene codes for a repressor protein. This repressor protein regulates transcription by binding to which specific region of the operon?

- A) Promoter
B) Operator
C) Structural gene z
D) Structural gene y

108.

If an mRNA codon sequence reads 5'-AUG-3', what will be the correct sequence of the corresponding tRNA anticodon read from 5' to 3'?

- A) 5'-UAC-3'
B) 5'-CAU-3'
C) 5'-AUG-3'
D) 5'-GUA-3'

109.

The fidelity of translation depends heavily on the accuracy of charging tRNA. Which enzyme is responsible for linking a specific amino acid to its cognate tRNA?

- A) RNA ligase
B) Peptidyl transferase
C) Aminoacyl-tRNA synthetase
D) Ribozyme

110.

Match the tRNA loop with its primary operational function inside the cell:

- A) DHU Loop → Binding to the mRNA codon
B) T ψ C Loop → Interaction with the ribosome
C) Anticodon Loop → Recognition by aminoacyl-tRNA synthetase
D) Acceptor stem → Splicing of mRNA

111.

What is the primary source of chemical energy expended during the aminoacylation (charging) process of a tRNA molecule?

- A) GTP hydrolysis to GDP B) ATP hydrolysis to AMP
C) Proton motive force D) Direct heat dissipation

112.

What is the very first step in the process of translation in a cell?

- A) Binding of mRNA to the larger ribosomal subunit B) Aminoacylation (charging) of tRNA
C) Formation of the first peptide bond D) Binding of initiation factors to mRNA

113.

In prokaryotes, which ribosomal subunit binds to the Shine-Dalgarno sequence on mRNA to correctly position the translation initiation complex?

- A) 50S subunit B) 40S subunit
C) 30S subunit D) 60S subunit

114.

Which amino acid is incorporated first into any newly synthesised polypeptide chain in prokaryotes versus eukaryotes?

- A) Methionine in both B) N-formylmethionine in prokaryotes, Methionine in eukaryotes
C) Methionine in prokaryotes, N-formylmethionine in eukaryotes D) Glycine in prokaryotes, Methionine in eukaryotes

115.

During elongation, peptide bond formation is catalysed by an enzyme that is actually an RNA molecule (ribozyme). Identify this component in bacterial systems:

- A) 18S rRNA B) 28S rRNA
C) 23S rRNA D) 5S rRNA

116.

During continuous protein synthesis, a newly arriving aminoacyl-tRNA (except the very first initiator tRNA) enters the ribosome at which site?

- A) P-site (Peptidyl site) B) A-site (Aminoacyl site)
C) E-site (Exit site) D) O-site (Operator site)

117.

How does a ribosome recognize the end of a translation message, and what binds to stop the process?

- A) It reads a stop codon, and a specific terminator tRNA binds to it. B) It reads a stop codon, and release factors bind to the A-site.
C) It hits a hairpin loop, causing the mRNA to detach. D) It runs out of ATP, terminating the process.

118.

What are Untranslated Regions (UTRs) on an mRNA molecule, and where are they located?

- A) Non-coding regions located only at the 5'-end before the start codon B) Non-coding regions located only at the 3'-end after the stop codon
C) Non-coding sequences present at both the 5'-end (before start) and 3'-end (after stop) D) Coding regions that are skipped by the ribosome during translation

119.

Assertion (A): The first phase of translation is the aminoacylation or charging of tRNA. Reason (R): Peptide bond formation between two amino acids is an energetically unfavourable process that requires pre-activation.

- A) If both Assertion and Reason are true and Reason is the correct explanation of Assertion. B) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
C) If Assertion is true but Reason is false. D) If both Assertion and Reason are false.

120.

Assertion (A): In prokaryotes, translation can begin long before the transcription of that specific mRNA molecule is complete. Reason (R): Prokaryotes lack a distinct nuclear membrane, allowing ribosomes to attach to mRNA while it is still being synthesised by RNA polymerase.

- A) If both Assertion and Reason are true and Reason is the correct explanation of Assertion. B) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
C) If Assertion is true but Reason is false. D) If both Assertion and Reason are false.

121.

In eukaryotic organisms, gene expression is highly complex and regulated at multiple stages. At which of the following levels does the primary or first step of regulation take place?

- A) Transport of mRNA from nucleus to cytoplasm B) Processing level (regulation of splicing)
C) Transcriptional level D) Translational level (formation of primary transcript)

122.

The lac operon in Escherichia coli is fundamentally classified as which type of operon system, and what is its default state in the absence of lactose?

- A) Inducible operon, normally switched ON B) Inducible operon, normally switched OFF
C) Repressible operon, normally switched ON D) Repressible operon, normally switched OFF

123.

The lac operon consists of three distinct structural genes: z, y, and a. Match these genes correctly with the specific enzymes they encode:

- A) $z \rightarrow$ Transacetylase, $y \rightarrow$ Permease, $a \rightarrow$ galactosidase B) $z \rightarrow$ Permease, $y \rightarrow$ B-galactosidase, $a \rightarrow$ Transacetylase
C) $z \rightarrow$ Permease, $y \rightarrow$ B-galactosidase, $a \rightarrow$ Transacetylase D) $z \rightarrow$ Transacetylase, $y \rightarrow$ Permease, $a \rightarrow$ galactosidase

124.

The regulatory gene of the lac operon, denoted as the i gene, functions continuously in the cell. What does the term i stand for, and what type of control does its product exert?

- A) Inducer, positive control B) Inhibitor, positive control
C) Inducer, negative control D) Inhibitor, negative control

125.

When lactose is introduced into the growth medium of E. coli, how does it physically trigger the activation of the lac operon structural genes?

- A) It binds directly to the RNA polymerase, speeding up transcription. B) It binds to the promoter region to recruit more ribosomes.
C) It binds to the repressor protein, altering its shape so it detaches from the operator. D) It breaks down the operator DNA sequence to open the path.

126.

If an *E. coli* culture is provided with a growth medium containing equal amounts of both glucose and lactose, what will be the status of the lac operon?

- A) It will be fully active because lactose is available. B) It will remain virtually inactive because glucose is the preferred, simpler energy source.
C) It will toggle wildly back and forth between active and inactive states. D) The genes will be permanently deleted from the bacterial chromosome.

127.

Assertion (A): If both glucose and lactose are provided together in the growth medium of *E. coli*, the structural genes of the lac operon are not expressed. **Reason (R):** Glucose is a preferred and simpler carbon source that actively exerts catabolite repression on alternative operons.

- A) If both Assertion and Reason are true and Reason is the correct explanation of Assertion. B) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
C) If Assertion is true but Reason is false. D) If both Assertion and Reason are false.

128.

Assertion (A): Transcription of the lac operon yields a single polycistronic mRNA molecule. **Reason (R):** In prokaryotes, multiple structural genes are often clustered together and controlled by a single shared promoter.

- A) If both Assertion and Reason are true and Reason is the correct explanation of Assertion. B) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
C) If Assertion is true but Reason is false. D) If both Assertion and Reason are false.

129.

Assertion (A): The regulatory gene of the lac operon is denoted as the *i* gene, where *i* stands for the inducer. **Reason (R):** The product of the *i* gene interacts directly with the operator to regulate transcription.

- A) If both Assertion and Reason are true and Reason is the correct explanation of Assertion. B) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
C) If Assertion is false but Reason is true. D) If both Assertion and Reason are false.

130.

When the mRNA template encounters the ribosome to begin translation, which specific component binds the mRNA first to initiate the process?

- A) The larger ribosomal subunit at the peptidyl site B) The smaller ribosomal subunit at the start codon
C) The catalytic ribozyme within the nucleoplasm D) The release factors at the untranslated region

131.

There are two primary sites in the large ribosomal subunit for subsequent amino acids to bind to. Why are these two sites critically positioned close to each other?

- A) To let the mRNA slide out of the ribosome rapidly B) To bring the carried amino acids close enough for peptide bond formation
C) To allow two separate mRNA molecules to be read at the same time D) To physically destroy uncharged tRNAs before they exit

132.

During protein synthesis, the ribosome moves along the mRNA template in a highly specific direction. what is this direction?

- A) 3' → 5' direction B) 5' → 3' direction
C) Bidirectional movement D) 3' → 3' circular movement starting from the middle

133.

While the initiator tRNA docks directly into the P-site during initiation, every subsequent incoming aminoacyl-tRNA carrying a single amino acid must enter the ribosome at which site?

- A) E-site (Exit site) B) P-site (Peptidyl site)
C) A-site (Aminoacyl site) D) O-site (Operator site)

134.

An mRNA molecule features a specific segment known as the "translational unit." According to NCERT definitions, what structural elements define the precise boundaries of this unit?

- A) The 5' cap and the 3' poly-A tail B) The promoter region and the terminator sequence
C) The segment bounded by the start codon and the stop codon D) The total span of the introns and exons combined

135.

During the termination phase, why do the codons UAA, UAG, and UGA cause translation to halt completely?

- A) They bind to specialized tRNAs that carry inhibitory amino acids. B) They cause the mRNA to physically break into small fragments.
C) They do not code for any amino acid, meaning no regular aminoacyl-tRNA can pair with them. D) They absorb all the ATP inside the ribosome, freezing the machinery.

Zoology

136.

Hypothalamus is the

- A) anterior part of diencephalon B) posterior part of diencephalon
C) interior part of diencephalon D) basal part of diencephalon

137.

Hypothalamus contains several groups of hormone producing neurosecretory cells called

- A) parietal cells B) oxyntic cells
C) nuclei D) G-cells

138.

Somatostatin from hypothalamus gland

- A) activates the release of growth hormone from the adrenal gland B) inhibits the release of growth hormone from the pituitary
C) inhibits the release of enzymes in the digestive tract D) activates the release of enzymes from the pineal gland

139.

Which of the following pituitary hormones works indirectly?

- A) MSH B) TSH
C) GH D) Oxytocin

140.

The activity of formation of milk and the ejection of milk is controlled by

- A) oxytocin and prolactin, respectively
 B) prolactin and oxytocin, respectively
 C) prolactin and prolactin, respectively
 D) oxytocin and oxytocin, respectively

141.

PTH is a

- A) hypercalcemic hormone
 B) hypocalcemic hormone
 C) endocalcemic hormone
 D) exocalcemic hormone

142.

Which of the following hormones can play a significant role in osteoporosis?

- A) Oestrogen and parathyroid hormone
 B) Progesterone and aldosterone
 C) Aldosterone and prolactin
 D) Parathyroid hormone and prolactin

143.

Increase in bleeding time and delay in blood coagulation is due to the deficiency of which hormone?

- A) Adrenaline
 B) Nor-adrenaline
 C) Parathormone
 D) Thyroxine

144.

A child with a weak immune system could have problem in which of the following glands?

- A) Thyroid gland
 B) Parathyroid gland
 C) Thymus
 D) Pituitary gland

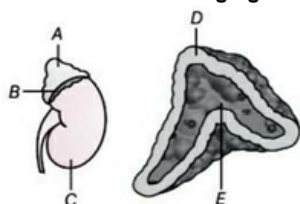
145.

Adrenal gland is present at the

- A) lateral side of each kidney
 B) dorsal side of each kidney
 C) posterior side of each kidney
 D) anterior side of each kidney

146.

Identify A to E in the following figure and choose the correct



option.

- A) A–Adrenal gland, B–Fat, C–Kidney, D–Adrenal cortex, E–Adrenal medulla
 B) A–Fat, B–Adrenal gland, C–Kidney, D–Adrenal cortex, E–Adrenal medulla
 C) A–Fat, B–Adrenal gland, C–Kidney, D–Adrenal medulla, E–Adrenal cortex
 D) A–Adrenal gland, B–Fat, C–Kidney, D–Adrenal medulla, E–Adrenal cortex

147.

Fight or flight reactions cause activation of

- A) the parathyroid glands, leading to increased metabolic rate
 B) the kidney, leading to suppression of renin angiotensin-aldosterone pathway
 C) the adrenal medulla, leading to increased secretion of epinephrine and nor-epinephrine
 D) the pancreas leading to a reduction in the blood sugar levels

148.

A person entering an empty room suddenly finds a snake right in front on opening the door. Which one of the following is likely to happen in his neurohormonal control system?

- A) Sympathetic nervous system is activated releasing epinephrine and nor-epinephrine from adrenal medulla
 B) Neurotransmitters diffuse rapidly across the cleft and transmit a nerve impulse
 C) Hypothalamus activates the parasympathetic division of brain
 D) Sympathetic nervous system is activated releasing epinephrine and nor-epinephrine from adrenal cortex

149.

The layer of adrenal cortex from outer to inner region are

- A) zona glomerulosa, zona fasciculata, zona reticularis
 B) zona reticularis, zona glomerulosa, zona fasciculata
 C) zona fasciculata, zona reticularis, zona glomerulosa
 D) zona reticularis, zona fasciculata, zona glomerulosa

150.

Cortisol is involved in

- A) maintaining the cardiovascular system and kidney functions
 B) produces anti-inflammatory reactions
 C) stimulation of RBCs production
 D) All of the above

151.

Islets of Langerhans are

- A) endocrine cells of adrenal medulla
 B) exocrine cells of adrenal cortex
 C) endocrine cells of pancreas
 D) exocrine cells of pancreas

152.

A patient of diabetes mellitus excretes glucose in urine even when he is kept on a carbohydrate free diet. It because

- A) fats are catabolised in adipose tissues to form glucose
 B) amino acids are catabolised in kidney to form glucose
 C) amino acids are discharged in blood stream from liver
 D) glycogen from muscles is released in blood stream

153.

The two main types of cells in the islets of Langerhans called α -cells and β -cells secrete

- A) glucagon and insulin, respectively
 B) insulin and glucagon, respectively
 C) insulin and glycogen, respectively
 D) glycogen and insulin, respectively

154.

Study the following table and select the correct option for endocrine gland, its hormone and its deficiency disorder.

	Endocrine glands	Hormones	Deficiency disorders
(a)	Neurohypophysis	Vasopressin	Diabetes mellitus
(b)	Adrenal cortex	Corticosteroids	Addison's disease
(c)	Parathyroid gland	Parathormone	Myxoedema
(d)	Thyroid gland	Calcitonin	Acromegaly

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

155.

The Leydig or interstitial cells found in the intertubular spaces produce a group of hormones called

- A) LH and FSH
B) Gonadotropins
C) Androgens
D) All of the above

156.

The steroid hormones, oestrogen and progesterone are secreted by which part/structure of ovary?

- A) Ova and Leydig cells, respectively
B) Ovarian follicle and corpus luteum, respectively
C) Corpus luteum and corpus albicans, respectively
D) Graafian follicle and ova, respectively

157.

A temporary endocrine gland in the human body

- A) pineal gland
B) corpus cardiacum
C) corpus luteum
D) corpus allatum

158.

Study the following table and identify A, B and C.

Glands	Secretion	Functions
A	Oestrogen	Secondary sexual characters
α -cells of Langerhans	B	Increases blood sugar level
Anterior lobe of pituitary	C	Over secretion leads to gigantism

- A) A – Ovary, B – Glucagon, C – GH
B) A – GH, B – Glucagon, C – PRL
C) A – GH, B – Glucagon, C – MSH
D) A – Ovary, B – Glucagon, C – MSH

159.

Which of the following pairs of hormones are not antagonistic (having opposite effects) to each other?

- A) Insulin — Glucagon
B) Aldosterone — Atrial natriuretic factor
C) Relaxin — Inhibin
D) Parathormone — Calcitonin

160.

Which of the following peptide hormone is secreted by non-endocrine gland?

- A) ANF and erythropoietin
B) Gastrin and secretin
C) Cholecystokinin and gastric inhibitory peptide
D) All of the above

161.

Which hormone acts on the exocrine part of pancreas and stimulates the secretion of water and bicarbonate ions?

- A) Gastric
B) Secretin
C) CCK
D) GIP

162.

GIP (Gastric Inhibitory Peptide)

- A) inhibits the gastric secretion and motility
B) inhibits the gastric secretion
C) stimulates the gastric secretion and motility
D) stimulates the gastric secretion

163.

Hormones produce their effects on target tissue by binding to specific proteins called as

- A) target proteins anywhere in body
B) activator proteins in muscles and glands
C) inhibitor proteins in blood
D) hormone receptors on target tissues

164.

Intracellular receptors are mostly

- A) cytoplasmic receptors
B) membrane receptors
C) nuclear receptors
D) ER receptors

165.

Among the following sets of hormones, which one contain only peptide hormones?

- A) Epinephrine, cortisol, pituitary hormones
B) TSH, hypothalamic hormones, oestradiol
C) Insulin, progesterone, cortisol
D) Insulin, glucagon, prolactin

166.

Hormones of which of the following endocrine glands lacks peptides, amines and sulphur?

- A) Testes
B) Thyroid and adrenal glands
C) Anterior pituitary
D) Posterior pituitary and pancreas

167.

Hormones, which interact with membrane bound receptors normally

- A) enters into the cell membrane
B) do not enter the target cell
C) generate secondary messengers
D) Both (b) and (c)

168.

What is the mechanism of action of steroid hormones?

- A) They enter into the target cells and bind with specific receptor and activate specific genes to form protein
B) They bind to cell membrane and activate specific genes to form protein
C) They catalyse the formation of AMP
D) None of the above

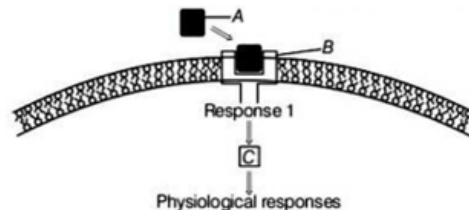
169.

If receptor molecules are removed from target organs, then the target organ will

- A) continue to respond to the hormone without any difference
B) continue to respond to the hormone, but will require higher concentration
C) continue to respond to the hormone, but in the opposite way
D) not respond to the hormone

170.

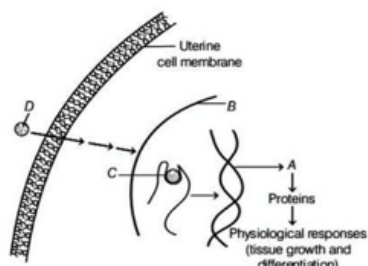
Identify A, B and C in the diagrammatic representation of the mechanism of hormone action.



- A) A–Steroid hormone, B –Hormone-receptor complex, C –Protein
B) A–Protein hormone, B –Receptor, C–Cyclic AMP
C) A–Steroid hormone, B –Receptor, C–Second messenger
D) A–Protein hormone, B–Cyclic AMP, C–Hormone-receptor complex

171.

Question: Identify *A* to *D* in the given diagrammatic representation of the mechanism of hormone action and choose the correct combination.



- A) *A*–DNA, *B*–Nucleus, *C*–Hormone-receptor complex, *D*–Hormone
 B) *A*–mRNA, *B*–Nucleus, *C*–Hormone-receptor complex, *D*–Hormone
 C) *A*–mRNA, *B*–Nucleus, *C*–Hormone-receptor complex, *D*–Protein
 D) *A*–DNA, *B*–Nucleus, *C*–Hormone-receptor complex, *D*–Protein

172.

Match the following hormones with the respective disease.

Column I	Column II
A. Insulin	1. Addison's disease
B. Thyroxine	2. Diabetes insipidus
C. Corticoids	3. Acromegaly
D. Growth hormone	4. Goitre
	5. Diabetes mellitus

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

173.

Match the following columns.

Column I (Hormones)	Column II (Functions)
A. FSH	1. Synthesises the milk in breast
B. MSH	2. Regulates the pigmentation
C. ADH	3. Prevents diuresis
D. PRL	4. Stimulates the development of ovarian follicle

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

174.

Match the following columns.

Column I (Hormones)	Column II (Functions)
A. Gastrin	1. Inhibits gastric secretion
B. Secretin	2. Acts on gall bladder
C. CCK	3. Stimulates secretion of H_2O and HCO_3^-
D. GIP	4. Secretion of HCl

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

175.

Match the following columns.

Column I (Types)	Column II (Examples)
A. Protein hormones	1. Epinephrine
B. Steroid hormones	2. Testosterone, progesterone
C. Iodothyronines hormones	3. Thyroid hormones
D. Amino acid derivative hormones	4. Insulin and glucagon

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

176.

Match the following columns and choose the correct option from the codes given below.

Column I (Types)	Column II (Glands)
A. Exocrine gland	1. Ovary
B. Endocrine gland	2. Thyroid
C. Heterocrine gland	3. Salivary glands

- A) A–3, B–2, C–1
 B) A–2, B–1, C–3
 C) A–2, B–3, C–1
 D) A–1, B–2, C–3

177.

Match the following columns.

Column I (Hormones of adrenal gland)	Column II (Functions)
A. Mineralocorticoids (Aldosterone)	1. Suppresses immune response
B. Cortisol	2. Growth of pubic hair and axial hair during puberty
C. Androgenic steroids of adrenal cortex	3. Increased blood glucose concentration
D. Catecholamine	4. Regulates balance of H_2O and electrolytes

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

178.

Match the following columns.

Column I (Hormones)	Column II (Functions)
A. ANF	1. Regulates blood calcium levels
B. MSH	2. Decreases blood pressure
C. GIP	3. Pigmentation
D. TCT	4. Inhibits gastric secretion

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

179.

Match the hormones with its sources of secretion.

Column I (Hormones)	Column II (Sources of secretion)
A. Somatostatin	1. Pineal gland
B. Melatonin	2. Corpus luteum
C. Aldosterone	3. Placenta
D. Progesterone	4. Adrenal cortex
E. HCG	5. Islets of Langerhans

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

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

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

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

180.

Match the following columns.

Column I	Column II
A. Adrenaline	1. Myxoedema
B. Hyperparathyroidism	2. Accelerates heartbeat
C. Oxytocin	3. Salt-water balance
D. Hypothyroidism	4. Childbirth
E. Aldosterone	5. Demineralisation

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

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

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

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

ANSWER KEY

Physics

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

Chemistry

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

Botany

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

Zoology

136.	4	144.	3	152.	1	160.	4
137.	3	145.	4	153.	1	161.	2
138.	2	146.	1	154.	2	162.	1
139.	2	147.	3	155.	3	163.	4
140.	2	148.	1	156.	2	164.	3
141.	1	149.	1	157.	3	165.	4
142.	1	150.	4	158.	1	166.	1
143.	3	151.	3	159.	3	167.	4

168.	1	172.	2	176.	1	180.	3
169.	4	173.	2	177.	3		
170.	2	174.	3	178.	4		
171.	2	175.	3	179.	4		

SOLUTIONS

Q1.

Answer: D

Explanation:

The magnetic field (B) produced by a long, straight wire carrying a steady current (I) at a perpendicular distance (R) is given by Ampere's Law (or derived from the Biot-Savart Law). The formula is: $B = \frac{\mu_0 I}{2\pi R}$ Where: μ_0 is the permeability of free space (a constant). I is the current flowing through the wire. R is the distance from the wire. 2π is a constant. From this equation, we can see the relationship of proportionality: The magnetic field B is directly proportional to the current I ($B \propto I$). The magnetic field B is inversely proportional to the distance R ($B \propto \frac{1}{R}$). Combining these relationships, the magnetic field is proportional to the ratio of current to distance: $B \propto \frac{I}{R}$. Therefore, the correct option is D.

Q2.

Answer: D

Explanation:

Magnetic field due to straight segments The straight segments lie along the radial lines passing through the center 'O'. For these segments, the angle between the current element $d\vec{l}$ and the position vector $\vec{r}$ is either 0° or 180° . Since $d\vec{B} \propto d\vec{l} \times \vec{r} = 0$, the magnetic field contribution from the straight segments is zero. Magnetic field due to semicircular arcs The magnitude of the magnetic field at the center of a circular arc carrying current I with radius r and subtending angle θ is given by: $B = \frac{\mu_0 I \theta}{4\pi r}$ For a semicircle, $\theta = \pi$, so the formula simplifies to: $B = \frac{\mu_0 I}{4r}$ Field due to inner arc (B_1): Radius $r = a$. $B_1 = \frac{\mu_0 I}{4a}$ Field due to outer arc (B_2): Radius $r = 4a$. $B_2 = \frac{\mu_0 I}{4(4a)} = \frac{\mu_0 I}{16a}$ Direction and Net Magnetic Field Since the loop is a closed circuit, the current must flow in opposite rotational directions along the two arcs (e.g., if it flows counter-clockwise on the inner arc, it must flow clockwise on the outer arc to return). Therefore, the magnetic fields produced by the two arcs at the center 'O' will be in opposite directions. The field from the inner arc is stronger ($1/4a > 1/16a$). The net magnetic field magnitude is the difference between the two fields:

$$B_{net} = B_1 - B_2 = \frac{\mu_0 I}{4a} - \frac{\mu_0 I}{16a} \quad B_{net} = \frac{4\mu_0 I - \mu_0 I}{16a} = \frac{3\mu_0 I}{16a}$$

Q3.

Answer: A

Explanation:

The magnetic field at the center of a circular current loop is given by the formula: $B = \frac{\mu_0 I}{2R}$ The direction is determined by the right-hand rule (perpendicular to the plane of the loop). 1. Loop in the xy-plane (Current $3I_0$): This loop lies in the horizontal plane, so its magnetic field at the origin will be along the z-axis. Magnitude: $B_1 = \frac{\mu_0(3I_0)}{2R}$. Direction: Based on the current direction shown (and consistent with the correct answer), the field points in the negative z-direction ($-\hat{z}$). $\vec{B}_1 = -\frac{3\mu_0 I_0}{2R} \hat{z}$ 2. Loop in the xz-plane (Current I_0): This loop lies in the vertical plane, so its magnetic field at the origin will be along the y-axis (the normal to the xz-plane). Magnitude: $B_2 = \frac{\mu_0 I_0}{2R}$. Direction: Based on the current direction, the field points in the positive y-direction ($+\hat{y}$). $\vec{B}_2 = \frac{\mu_0 I_0}{2R} \hat{y}$ 3. Resultant Magnetic Field ($\vec{B}$): Adding the two vector components: $\vec{B} = \vec{B}_1 + \vec{B}_2$ $\vec{B} = -\frac{3\mu_0 I_0}{2R} \hat{z} + \frac{\mu_0 I_0}{2R} \hat{y}$ $\vec{B} = \frac{\mu_0 I_0}{2R} (-3\hat{z} + \hat{y})$ This matches Option A.

Q4.

Answer: B

Explanation:

The magnetic field at the center of the hexagonal loop is the vector sum of the magnetic fields produced by each of its 6 sides. Due to symmetry, each side contributes an equal magnetic field in the same direction. 1. Magnetic field due to one side: The formula for the magnetic field due to a finite straight wire of length L at a perpendicular distance d is:

$B = \frac{\mu_0 I}{4\pi d} (\sin \theta_1 + \sin \theta_2)$ For a regular hexagon of side a : The triangle formed by the center and any side is an equilateral triangle. The perpendicular distance from the center to the side (apothem) is

$d = a \sin(60^\circ) = \frac{\sqrt{3}}{2} a$. The angles subtended by the ends of the side at the center with the perpendicular are $\theta_1 = \theta_2 = 30^\circ$. Substituting these values: $B_{side} = \frac{\mu_0 I}{4\pi(\frac{\sqrt{3}}{2} a)} (\sin 30^\circ + \sin 30^\circ)$

$B_{side} = \frac{\mu_0 I}{2\sqrt{3}\pi a} (\frac{1}{2} + \frac{1}{2}) = \frac{\mu_0 I}{2\sqrt{3}\pi a}$ 2. Total Magnetic Field: Since there are 6 sides, the total magnetic field B_{net} is: $B_{net} = 6 \times B_{side}$

$B_{net} = 6 \times \frac{\mu_0 I}{2\sqrt{3}\pi a} \quad B_{net} = \frac{3\mu_0 I}{\sqrt{3}\pi a} \quad B_{net} = \frac{\sqrt{3}\mu_0 I}{\pi a}$ Therefore, the correct option is B.

Q5.

Answer: A

Explanation:

The magnetic field B at a point O located at a perpendicular distance d from a finite straight current-carrying wire is given by the formula:

$B = \frac{\mu_0 I}{4\pi d} (\cos \phi_1 + \cos \phi_2)$. where ϕ_1 and ϕ_2 are the angles between the wire axis and the position vectors from the ends of the wire to the point O .

1. Straight Segments: The infinite straight parts of the wire lie along the axis passing through point O (the bottom dashed line). Since the angle between the current element and the position vector is 0° or 180° , the magnetic field due to these segments is zero ($d\vec{l} \times \vec{r} = 0$).

2. Top Segment: The top horizontal segment is at a perpendicular distance d from O . The angles subtended by the ends of this segment at O with the wire direction are ϕ_1 and ϕ_2 (as marked in the diagram).

3. Calculation: Applying the formula for this segment, we get

$$B = \frac{\mu_0 I}{4\pi d} (\cos \phi_1 + \cos \phi_2).$$

Q6.

Answer: A

Explanation:

The magnitude of the magnetic force per unit length (F/L) between two long, parallel current-carrying wires is given by the formula: $\frac{F}{L} = \frac{\mu_0 I_1 I_2}{2\pi D}$ From this equation, we can see that the force is directly proportional to the product of the currents ($I_1 I_2$) and inversely proportional to the distance separating them (D). Therefore, the force is proportional to: $\frac{I_1 I_2}{D}$ This corresponds to Option A.

Q7.

Answer: B

Explanation:

The magnetic field at point 'O' is the vector sum of the fields produced by the major circular arc and the straight chord.

1. Magnetic Field due to the Major Arc (B_1): The arc subtends an angle of $360^\circ - 60^\circ = 300^\circ = \frac{5\pi}{3}$ radians at the center.

$B_1 = \frac{\mu_0 I_0}{4\pi R} \left(\frac{5\pi}{3} \right) = \frac{5\mu_0 I_0}{12R}$ Direction: Into the page (based on clockwise current flow).

2. Magnetic Field due to the Straight Chord (B_2): The chord forms an equilateral triangle with the center (since the angle is 60° and radii are equal). The perpendicular distance from 'O' to the wire is

$d = R \sin(60^\circ) = \frac{\sqrt{3}R}{2}$. The angles subtended by the ends of the wire at the perpendicular are 30° each.

$B_2 = \frac{\mu_0 I_0}{4\pi d} (\sin 30^\circ + \sin 30^\circ) = \frac{\mu_0 I_0}{4\pi(\frac{\sqrt{3}R}{2})} (1) = \frac{\mu_0 I_0}{2\sqrt{3}\pi R}$ Direction: Into the page (current flows right to left, point O is above).

3. Total Magnetic Field (B_{net}):

Since both fields are in the same direction, we add them:

$B_{net} = B_1 + B_2 = \frac{5\mu_0 I_0}{12R} + \frac{\mu_0 I_0}{2\sqrt{3}\pi R}$ Factoring out $\frac{5\mu_0 I_0}{12R}$:

$B_{net} = \frac{5\mu_0 I_0}{12R} \left[1 + \frac{12R}{5\mu_0 I_0} \cdot \frac{\mu_0 I_0}{2\sqrt{3}\pi R} \right] = \frac{5\mu_0 I_0}{12R} \left[1 + \frac{6}{5\sqrt{3}\pi} \right]$ Rationalizing

$\frac{6}{5\sqrt{3}} = \frac{2\sqrt{3}}{5}$: $B_{net} = \frac{5\mu_0 I_0}{12R} \left[1 + \frac{2\sqrt{3}}{5} \right]$ Therefore, the correct option is B.

Q8.

Answer: A

Explanation:

The Lorentz force is the total electromagnetic force acting on a point charge due to both electric and magnetic fields. It is the vector sum of the electric force and the magnetic force.

Q9.

Answer: A

Explanation:

The frequency of revolution is the inverse of the time period. Since the time period is independent of the speed and radius, the frequency depends only on the charge-to-mass ratio and the magnetic field strength.

Q10.

Answer: C

Explanation:

Curvature is the reciprocal of the radius of the path. Since both particles have the same momentum and same magnitude of charge, their orbital radii are identical, resulting in equal curvature.

Q11.

Answer: B

Explanation:

Using Fleming's Left-Hand Rule, we can determine the direction of the force on a moving charge. For an electron, the force is opposite to the direction predicted for a positive current.

Q12.

Answer: A

Explanation:

For a charged particle moving in a magnetic field, the radius of the circular path is $r = \frac{mv}{qB}$. Given the same kinetic energy $K = \frac{1}{2}mv^2$, we have

$v = \sqrt{\frac{2K}{m}}$, so $r = \frac{\sqrt{2mK}}{qB} \propto \frac{\sqrt{m}}{q}$. For proton: $m_p, q_p = e$, so $r_p \propto \frac{\sqrt{m_p}}{e}$

For deuteron: $m_d = 2m_p, q_d = e$, so $r_d \propto \frac{\sqrt{2m_p}}{e} = \sqrt{2} \frac{\sqrt{m_p}}{e}$ For α -

particle: $m_\alpha = 4m_p, q_\alpha = 2e$, so $r_\alpha \propto \frac{\sqrt{4m_p}}{2e} = \frac{2\sqrt{m_p}}{2e} = \frac{\sqrt{m_p}}{e}$

Therefore, $r_\alpha = r_p < r_d$

Q13.

Answer: A

Explanation:

The current configuration consists of three parts carrying current Segment 1 is the straight inlet wire whose line of action passes directly through center O, contributing $B_1 = 0$

The total current i splits equally into two semi-circular paths, each carrying current $I = \frac{i}{2}$

Segment 2 is the upper semi-circular arc of radius R carrying current

$I = \frac{i}{2}$ clockwise, producing $B_2 = \frac{K(i/2)}{R} \pi \otimes$

Segment 3 is the lower semi-circular arc of radius R carrying current $I = \frac{i}{2}$ counter-clockwise, producing $B_3 = \frac{K(i/2)}{R} \pi \odot$

Segment 4 is the straight outlet wire whose line of action passes directly through center O, contributing $B_4 = 0$

Total magnetic field vector at center O is $\vec{B}_O = \vec{B}_1 + \vec{B}_2 + \vec{B}_3 + \vec{B}_4$

Substituting individual contributions yields $\vec{B}_O = 0 + \frac{Ki\pi}{2R} \otimes + \frac{Ki\pi}{2R} \odot + 0$

Since the magnetic fields of equal magnitude are in opposite directions,

$\vec{B}_O = \frac{Ki\pi}{2R} - \frac{Ki\pi}{2R} = 0$

Q14.

Answer: C

Explanation:

The magnetic force between two parallel wires depends on the product of their currents and inversely on the distance between them. Calculating the force for both pairs shows they are equal.

Q15.

Answer: D

Explanation:

The magnetic field at the center of a circular arc is a fraction of the field produced by a full circle, determined by the ratio of the subtended angle to 2π .

Q16.

Answer: C

Explanation:

For a long straight wire, the magnetic field is inversely proportional to the distance from the wire. Reducing the distance by half doubles the field strength.

Q17.

Answer: A

Explanation:

The magnetic field at the center of a circular coil is directly proportional to the number of turns and the current, and inversely proportional to the radius of the coil.

Q18.

Answer: C

Explanation:

The total field is the sum of the fields produced by each semicircle. Since the currents flow such that both fields point into the page, their magnitudes add.

Q19.

Answer: B

Explanation:

This arc is a quarter circle. Its field is $1/4$ of the field produced by a full circular loop of the same radius.

Q20.

Answer: B

Explanation:

Increasing the turns to n using the same wire length reduces the radius to $1/n$. Since the field is proportional to n/r , the new field becomes n^2 times the original.

Q21.

Answer: D

Explanation:

Due to the symmetric distribution of current in a uniform conductor, the magnetic fields produced by different segments at the center cancel each other out perfectly.

Q22.

Answer: B

Explanation:

The magnetic field at the center of the arc is only due to the semicircular segment, as the straight segments lie on a line passing through the center.

Q23.

Answer: A

Explanation:

The magnetic field at the center of the loop is the vector sum of the magnetic field due to the infinitely long straight wire and the magnetic field due to the circular loop. 1. Straight Wire: The conductor acts as an infinitely long straight wire carrying current I . The center of the loop is at a perpendicular distance R from this wire. The magnetic field is $B_1 = \frac{\mu_0 I}{2\pi R}$. By the right-hand rule (current to the right), the field at the center (above the wire) is directed out of the page. 2. Circular Loop: The loop carries current I in a counter-clockwise direction (indicated by arrows). The magnetic field at the center is $B_2 = \frac{\mu_0 I}{2R}$. By the right-hand rule, this field is also directed out of the page. Since both fields are in the same direction, they add up: $B_{total} = B_1 + B_2 = \frac{\mu_0 I}{2\pi R} + \frac{\mu_0 I}{2R} = \frac{\mu_0 I}{2\pi R} (1 + \pi)$. Rewriting the coefficient: $\frac{\mu_0 I}{2\pi R} = \frac{\mu_0 2I}{4\pi R}$. So, $B_{total} = \frac{\mu_0 2I}{4\pi R} (\pi + 1)$.

Q24.

Answer: A

Explanation:

By equating the formula for the magnetic field on the axis to $1/8$ of the center field value, we can solve for the axial distance x .

Q25.

Answer: A

Explanation:

The loop consists of a major circular arc and a straight chord. The total field is the vector sum of fields from both segments.

Q26.

Answer: D

Explanation:

Since the coils are perpendicular, their magnetic field vectors at the center are also perpendicular. The resultant is found using the Pythagorean theorem.

Q27.

Answer: D

Explanation:

The magnetic field at point O is the vector sum of the fields produced by three segments of the wire: 1. The vertical straight segment: The current flows along the line passing through O . Since the angle between the current element $d\vec{l}$ and position vector $\vec{r}$ is 0 or 180° , the magnetic field contribution is zero ($B_1 = 0$). 2. The semi-circular arc: This is a semi-circle of radius R (implied). The magnetic field at the center of a semi-circle is half that of a full circle. $B_2 = \frac{1}{2} \left(\frac{\mu_0 I}{4R} \right) = \frac{\mu_0 I}{4R}$. By the right-hand rule (current is counter-clockwise), the direction is out of the page. 3. The horizontal straight segment: This is a semi-infinite wire starting at a distance R from O (tangent to the circle at the bottom) and extending to infinity. The magnetic field due to a semi-infinite wire at a perpendicular distance R from its end is $B_3 = \frac{1}{2} \left(\frac{\mu_0 I}{2\pi R} \right) = \frac{\mu_0 I}{4\pi R}$. By the right-hand rule (current to the right, point above), the direction is out of the page. Since B_2 and B_3 are in the same direction, they add up: $B_{total} = \frac{\mu_0 I}{4R} + \frac{\mu_0 I}{4\pi R}$.

Q28.

Answer: A

Explanation:

The total magnetic field at the center is the vector sum of the fields from the two semicircular arcs. Because the inner radius R_2 is smaller than the outer radius R_1 , the magnetic field produced by the inner arc is stronger. The net magnitude is the difference between these two fields.

Q29.

Answer: C

Explanation:

For a circular coil, the magnetic field at the center is inversely proportional to the radius. Doubling the radius reduces the field by half.

Q30.

Answer: B

Explanation:

The radial segments contribute no field at the center. The only contribution is from the circular arc, calculated by its angle (120°).

Q31.

Answer: B

Explanation:

The total magnetic field at the center is the sum of the fields produced by each of the n sides of the polygon. Since the polygon is regular, each side contributes equally. For one side of length L , the perpendicular distance from the center is $d = a \cos(\pi/n)$. The angle subtended by half the side at the center is $\theta = \pi/n$. Using the formula for the magnetic field due to a finite straight wire: $B_{side} = \frac{\mu_0 i}{4\pi d} (\sin \theta + \sin \theta)$. Substituting the values and multiplying by n gives the total field.

Q32.

Answer: A

Explanation:

Calculate the magnetic field at the center of the square and the circle using their respective formulas, ensuring the perimeter (total length of wire) remains constant to find the relationship between the square side and circle radius.

Q33.

Answer: B

Explanation:

The total current divides into two paths based on resistance. The magnetic fields produced by these two paths at the center point in opposite directions, and their vector sum provides the net field.

Q34.

Answer: B

Explanation:

The magnetic field at the center P is the superposition of fields due to the circular arcs and the straight wire segments. We use the unit $B_0 = \frac{\mu_0 I}{2\pi r}$. - For a circular arc subtending angle θ at the center, $B = \frac{\theta}{2} B_0$. - For a semi-infinite straight wire tangent to the circle (distance r), $B = \frac{1}{2} B_0$. - For a straight wire pointing radially towards/away from the center, $B = 0$. Case 1: The shape consists of a semi-circle (angle π) and two semi-infinite straight wires. Based on the direction (clockwise arc, straight wires contributing positively), the field is proportional to $-\frac{\pi}{2} + \frac{1}{2} + \frac{1}{2} = -\frac{\pi}{2} + 1$. Case 2: The shape consists of a semi-circle (angle π) and two semi-infinite straight wires. The field is proportional to $\frac{\pi}{2} + \frac{1}{2} + \frac{1}{2} = \frac{\pi}{2} + 1$. Case 3: The shape consists of a $\frac{3}{4}$ circle (angle $\frac{3\pi}{2}$) and one semi-infinite straight wire (the other is radial). The field is proportional to $\frac{3\pi/2}{2} + \frac{1}{2} = \frac{3\pi}{4} + \frac{1}{2}$.

Q35.

Answer: B

Explanation:

The magnetic field at the center is the vector sum of the fields produced by the 4 sides of the square. For one side of length a , the perpendicular distance from the center is $d = a/2$. The angles subtended by the ends of the wire at the center are $\theta_1 = \theta_2 = 45^\circ$. Using the formula

$B = \frac{\mu_0 I}{4\pi d} (\sin \theta_1 + \sin \theta_2)$, the field due to one side is

$B_1 = \frac{\mu_0 I}{4\pi(a/2)} (2 \sin 45^\circ) = \frac{\sqrt{2}\mu_0 I}{2\pi a}$. The total field is

$B_{total} = 4 \times B_1 = \frac{2\sqrt{2}\mu_0 I}{\pi a}$.

Q36.

Answer: A

Explanation:

The magnetic force acts as the centripetal force: $qvB = \frac{mv^2}{r}$. This gives

velocity $v = \frac{qBr}{m}$. The time period is $T = \frac{2\pi r}{v}$. Substituting v , we get

$T = \frac{2\pi r}{\frac{qBr}{m}} = \frac{2\pi m}{qB}$.

Q37.

Answer: B

Explanation:

The radius of the circular path is given by $r = \frac{\sqrt{2mK}}{qB}$. Since kinetic energy (K), charge magnitude (q), and magnetic field (B) are the same for both particles, the radius is proportional to the square root of the mass ($r \propto \sqrt{m}$). Since the mass of a proton is greater than the mass of an electron ($m_p > m_e$), the radius of the proton's path is larger ($r_p > r_e$). A larger radius implies less curvature. Therefore, the path of the proton is less curved.

Q38.

Answer: A

Explanation:

The radius of a charged particle in a magnetic field is given by $r = \frac{p}{qB}$,

where p is momentum. Since momentum (p) and magnetic field (B) are the same for all particles, the radius is inversely proportional to the charge ($r \propto \frac{1}{q}$). The charges are $q_p = e$, $q_d = e$, and $q_\alpha = 2e$. Therefore, $r_p \propto \frac{1}{e}$, $r_d \propto \frac{1}{e}$, and $r_\alpha \propto \frac{1}{2e}$. This implies $r_p = r_d$ and both are greater than r_α (since dividing by 2 gives a smaller value). Thus, $r_p = r_d > r_\alpha$.

Q39.

Answer: C

Explanation:

The length of the wire forms the circumference of the circle:

$2\pi r = 4 \Rightarrow r = \frac{2}{\pi}$. The area of the circle is $A = \pi r^2 = \pi \left(\frac{2}{\pi}\right)^2 = \frac{4}{\pi}$.

The magnetic moment is $M = I \cdot A = 1 \cdot \frac{4}{\pi} = \frac{4}{\pi}$.

Q40.

Answer: A

Explanation:

The magnetic field due to a long straight wire is inversely proportional to the distance ($B \propto \frac{1}{r}$). If the distance is doubled ($r \rightarrow 2d$), the magnetic field becomes half. $B_{new} = \frac{B_0}{2}$.

Q41.

Answer: A

Explanation:

The formula for magnetic field at the center is $B = \frac{\mu_0 NI}{2R}$. Substituting the values: $B = \frac{4\pi \times 10^{-7} \times 100 \times 0.1}{2 \times 0.1}$.

$B = \frac{40\pi \times 10^{-7}}{0.2} = 200\pi \times 10^{-7} = 2\pi \times 10^{-5} \text{ T}$.

Q42.

Answer: B

Explanation:

The magnetic field at the center of a circular arc is a fraction of the field of a complete circular loop. The field for a full loop is $B_{loop} = \frac{\mu_0 i}{2R}$. The fraction is determined by the angle θ subtended by the arc: fraction = $\frac{\theta}{2\pi}$. Here,

$\theta = \pi/3$. So, fraction = $\frac{\pi/3}{2\pi} = \frac{1}{6}$. Therefore, $B = \frac{1}{6} \times \frac{\mu_0 i}{2R} = \frac{\mu_0 i}{12R}$.

Q43.

Answer: A

Explanation:

The given wire configuration consists of three distinct segments carrying current i

Segment 1 is a horizontal semi-infinite straight wire at perpendicular distance $r = R$ from point O

For segment 1, subtended angles are $\theta_1 = 90^\circ$ and $\theta_2 = 0^\circ$

Magnetic field magnitude due to segment 1 is

$B_1 = \frac{Ki}{R} (\sin 90^\circ + \sin 0^\circ) = \frac{Ki}{R} (1 + 0) = \frac{Ki}{R}$

By the right-hand thumb rule, current in segment 1 produces a magnetic field at point O directed out of the page ($\odot$)

Segment 2 is a circular arc of radius R subtending an angle $\theta = \frac{3\pi}{2}$ radians at center O

Magnetic field magnitude due to segment 2 is $B_2 = \frac{Ki}{R} \left(\frac{3\pi}{2}\right)$

By the right-hand thumb rule, counter-clockwise current in segment 2

produces a magnetic field directed out of the page ($\odot$)

Segment 3 is a horizontal semi-infinite straight wire whose line of action passes directly through point O, contributing $B_3 = 0$

Total magnetic field vector at point O is $\vec{B}_O = B_1 + B_2 + B_3$

Substituting individual contributions gives $\vec{B}_O = \frac{Ki}{R} \odot + \frac{Ki}{R} \left(\frac{3\pi}{2}\right) \odot + 0$

Factoring common terms yields $\vec{B}_O = \frac{Ki}{R} \left(\frac{3\pi}{2} + 1\right) \odot$

Q44.

Answer: B

Explanation:

The magnetic field at the center is $B_0 = \frac{\mu_0 I}{2R}$. The magnetic field on the axis

at distance x is $B_x = \frac{\mu_0 IR^2}{2(R^2+x^2)^{3/2}}$. Given $B_x = \frac{1}{5\sqrt{5}} B_0$. Substituting the

formulas: $\frac{R^2}{(R^2+x^2)^{3/2}} = \frac{1}{5\sqrt{5}R}$. This simplifies to

$(R^2 + x^2)^{3/2} = 5\sqrt{5}R^3 = (\sqrt{5})^3 R^3$. Taking the cube root and squaring leads to $x = 2R$.

Q45.

Answer: A

Explanation:

The magnetic field at the center of a circular coil is given by $B = \frac{\mu_0 I}{2R}$. For

the first coil: $B_1 = \frac{\mu_0 I}{2R}$. For the second coil:

$B_2 = \frac{\mu_0(2I)}{2(R/2)} = \frac{2\mu_0 I}{R} = 4 \left(\frac{\mu_0 I}{2R}\right) = 4B_1$. Therefore, the ratio $\frac{B_1}{B_2} = \frac{1}{4}$.

Q46.

Answer: C

Explanation:

Acetylene reacts with hypochlorous acid through addition across the triple bond, followed by further chlorination and rearrangement to form dichloroacetaldehyde.

Q47.

Answer: A

Explanation:

Acetylene reacts with ammoniacal silver nitrate, sodium in liquid ammonia, and hydrogen chloride. However, dilute sodium hydroxide does not react with acetylene, as it is not sufficiently acidic to react with a weak base like NaOH.

Q48.

Answer: C

Explanation:

The conversion of an alkene (butene-1) to an alkane (butane) is a catalytic hydrogenation reaction where hydrogen gas is added across the double bond.

Q49.

Answer: C

Explanation:

At higher temperatures (40°C), the 1,4-addition product is favored as it is the more stable thermodynamic product.

Q50.

Answer: D

Explanation:

For isomeric hydrocarbons, the boiling point decreases with increase in branching due to reduced surface area and weaker van der Waals forces.

Q51.

Answer: B

Explanation:

Addition of two equivalents of HBr to propyne follows Markovnikov's rule for both additions, placing both bromine atoms on the central carbon.

Q52.

Answer: D

Explanation:

Grignard reagents (RMgX) react with compounds containing acidic hydrogens (like terminal alkynes) to produce the corresponding alkane.

Q53.

Answer: B

Explanation:

Terminal alkynes possess acidic hydrogens that react with sodium in liquid ammonia to liberate hydrogen gas.

Q54.

Answer: D

Explanation:

The given alkene is 2-butene. On ozonolysis followed by reductive workup using zinc and water, the double bond is cleaved, producing two molecules of acetaldehyde (CH_3CHO).

Q55.

Answer: C

Explanation:

An aldehyde with molecular mass 44 u is ethanal (CH_3CHO).
 $12 \times 2 + 1 \times 4 + 16 = 24 + 4 + 16 = 44$ Ozonolysis of the symmetrical alkene 2-butene produces two molecules of ethanal, satisfying the given condition.

Q56.

Answer: C

Explanation:

Ozonolysis cleaves a double bond ($\text{C}=\text{C}$) and replaces it with two $\text{C}=\text{O}$ bonds. Working backward from acetone and propionaldehyde identifies the original alkene.

Q57.

Answer: A

Explanation:

Hydration of propyne in the presence of $\text{HgSO}_4/\text{H}_2\text{SO}_4$ follows Markovnikov's rule, forming an enol that rapidly undergoes keto-enol tautomerism to give acetone (propanone).

Q58.

Answer: C

Explanation:

Kolbe's electrolysis of salts of dicarboxylic acids like succinate leads to the formation of alkenes.

Q59.

Answer: B

Explanation:

The reduction of internal alkynes to trans-alkenes is achieved through Birch reduction using an alkali metal (like Li or Na) in liquid ammonia.

Q60.

Answer: C

Explanation:

Hydration of internal alkynes with $\text{Hg}^{2+}/\text{H}^+$ leads to an enol that tautomerizes to a stable ketone. In 1-phenylpropyne, the carbonyl forms adjacent to the phenyl ring to maintain conjugation.

Q61.

Answer: C

Explanation:

Similar to other internal alkynes, diphenylacetylene is reduced to its trans-isomer (trans-stilbene) using Birch reduction conditions.

Q62.

Answer: A

Explanation:

The radical chain mechanism for anti-Markovnikov addition requires both propagation steps to be exothermic. For HCl and HI, at least one propagation step is endothermic, making the overall radical reaction unfavorable compared to the ionic Markovnikov pathway.

Q63.

Answer: C

Explanation:

Hydroboration-oxidation results in the overall anti-Markovnikov addition of water across a double bond, placing the hydroxyl group on the less substituted carbon.

Q64.

Answer: D

Explanation:

The addition yields 2-bromo-3-methylpentane, which contains two chiral centers. The total number of stereoisomers is 2^n , where n is the number of chiral centers.

Q65.

Answer: D

Explanation:

Compound X is cis-2-butene (from Lindlar reduction) and Y is trans-2-butene (from Birch reduction). The cis-isomer is polar and has higher intermolecular forces than the non-polar trans-isomer.

Q66.

Answer: B

Explanation:

Hydrogen bromide adds to the double bond according to Markovnikov's rule. Protonation forms the more stable benzylic carbocation, which is then attacked by Br^- to give 1-bromo-1-phenylpropane.

Q67.

Answer: C

Explanation:

Reduction of alkynes with sodium in liquid ammonia (dissolving metal reduction) proceeds by anti-addition of hydrogen atoms, producing the trans-alkene. In contrast, $\text{H}_2/\text{Pd} - \text{BaSO}_4$ (Lindlar catalyst) gives the cis-alkene.

Q68.

Answer: D

Explanation:

In the first step, DCl adds to propyne according to Markovnikov's rule. Chlorine attaches to the more substituted carbon, while deuterium (D) adds to the terminal carbon. In the second step, DI adds across the double bond, again following Markovnikov addition, giving the final product.

Q69.

Answer: C

Explanation:

Hot alkaline potassium permanganate followed by acidification causes oxidative cleavage of the double bond. Since but-2-ene is a symmetrical alkene, it produces two molecules of acetic acid.

Q70.

Answer: B

Explanation:

The reaction of an alkene with chlorine water (Cl_2/H_2O) forms a halohydrin. The addition is regioselective, following a Markovnikov-like path where the nucleophile (OH from water) attacks the more stable (more substituted) carbocation-like center.

Q71.

Answer: A

Explanation:

Hydration of an internal alkyne with Hg^{2+}/H^+ involves the formation of a stable carbocation. The electron-donating methoxy group ($-OCH_3$) stabilizes the carbocation on the adjacent carbon via resonance, leading to the formation of the ketone at that position.

Q72.

Answer: B

Q73.

Answer: D

Explanation:

The reaction follows an ionic mechanism starting with the formation of a secondary carbocation, which then undergoes a 1,2-hydride shift to form a more stable tertiary carbocation before the bromide ion attacks.

Q74.

Answer: B

Explanation:

Geometrical isomerism is possible when each carbon atom of the double bond is attached to two different groups.

Q75.

Answer: D

Q76.

Answer: A

Explanation:

Toluene consists of a planar benzene ring where all 6 carbons and 5 hydrogens attached to the ring are in one plane. Additionally, two atoms from the methyl group can align in that same plane.

Q77.

Answer: D

Explanation:

The sequence involves alkyne hydration to a ketone, Grignard addition to an alcohol, and finally dehydration to a substituted alkene.

Q78.

Answer: B

Explanation:

Hydroboration-oxidation converts the alkene into an alcohol via anti-Markovnikov hydration. On heating with dilute sulfuric acid, the alcohol undergoes acid-catalyzed dehydration/rearrangement, yielding the major alkene shown as Option B.

Q79.

Answer: A

Explanation:

Heat of combustion is inversely proportional to the stability of the isomer. Trans-isomers are generally more stable than cis-isomers due to less steric hindrance.

Q80.

Answer: A

Explanation:

The addition of bromine to cis-but-2-ene is an anti-addition, which yields a racemic mixture of two enantiomers.

Q81.

Answer: A

Explanation:

Density increases with the introduction of heavier halogen atoms and an increasing number of halogens on the benzene ring.

Q82.

Answer: D

Explanation:

The strongly electron-withdrawing CF_3 group destabilizes the carbocation expected from Markovnikov addition. As a result, protonation occurs in the opposite direction, leading predominantly to the anti-Markovnikov product.

Q83.

Answer: C

Explanation:

The reaction involves the electrophilic addition of HCl to allyl benzene. It proceeds via a carbocation intermediate that undergoes a 1,2-hydride shift to form a more stable benzylic carbocation before the final attachment of the chloride ion.

Q84.

Answer: D

Explanation:

HI does not exhibit the peroxide effect (Kharasch effect) because the addition of the iodine radical to the double bond is endothermic. Instead of adding, iodine radicals prefer to recombine into molecular iodine.

Q85.

Answer: B

Explanation:

Cyclic polymerization of acetylene (ethyne) leads to the formation of aromatic hydrocarbons, which are characterized as cyclic poly-enes due to their alternating double bonds.

Q86.

Answer: A

Explanation:

Oxymercuration-demercuration results in the Markovnikov addition of water across a double bond. Unlike standard acid-catalyzed hydration, this method avoids carbocation rearrangements.

Q87.

Answer: D

Q88.

Answer: D

Explanation:

The addition of hypochlorous acid (HOCl) to an alkene follows Markovnikov regioselectivity. The electrophile (Cl^+) adds to the terminal carbon to form the more stable secondary carbocation intermediate.

Q89.

Answer: B

Explanation:

In the presence of Br_2 and light ($h\nu$), the reaction proceeds via free radical allylic bromination. Bromine selectively replaces the most stable allylic hydrogen, which is the tertiary allylic hydrogen on the carbon bearing the methyl group. Hence, Option B is the major product.

Q90.

Answer: C

Explanation:

Geometrical (E/Z) isomerism is possible only when each carbon of the double bond is attached to two different groups. Among the given compounds, Option C satisfies this condition because the ring carbon of the exocyclic double bond is attached to two non-equivalent paths due to the two methyl substituents on the ring.

Q91.

Answer: B

Q92.

Answer: D

Q93.

Answer: B

Q94.

Answer: B

Q95.

Answer: B

Q96.

Answer: B

Q97.

Answer: B

Q98.

Answer: B

Q99.

Answer: C

Q100.

Answer: A

Q101.

Answer: D

Q102.

Answer: C

Q103.

Answer: B

Q104.

Answer: C

Q105.

Answer: A

Q106.

Answer: D

Q107.

Answer: B

Q108.

Answer: B

Q109.

Answer: C

Q110.

Answer: B

Q111.

Answer: B

Q112.

Answer: B

Q113.

Answer: C

Q114.

Answer: B

Q115.

Answer: C

Q116.

Answer: B

Q117.

Answer: B

Q118.

Answer: C

Q119.

Answer: A

Q120.

Answer: A

Q121.

Answer: C

Q122.

Answer: B

Q123.

Answer: B

Q124.

Answer: D

Q125.

Answer: C

Q126.

Answer: B

Q127.

Answer: A

Q128.

Answer: A

Q129.

Answer: C

Q130.

Answer: B

Q131.
Answer: B

Q132.
Answer: B

Q133.
Answer: C

Q134.
Answer: C

Q135.
Answer: C

Q136.
Answer: D

Q137.
Answer: C

Q138.
Answer: B

Q139.
Answer: B

Q140.
Answer: B

Q141.
Answer: A

Q142.
Answer: A

Q143.
Answer: C

Q144.
Answer: C

Q145.
Answer: D

Q146.
Answer: A

Q147.
Answer: C

Q148.
Answer: A

Q149.
Answer: A

Q150.
Answer: D

Q151.
Answer: C

Q152.
Answer: A

Q153.
Answer: A

Q154.
Answer: B

Q155.
Answer: C

Q156.
Answer: B

Q157.
Answer: C

Q158.
Answer: A

Q159.
Answer: C

Q160.
Answer: D

Q161.
Answer: B

Q162.
Answer: A

Q163.
Answer: D

Q164.
Answer: C

Q165.
Answer: D

Q166.
Answer: A

Q167.
Answer: D

Q168.
Answer: A

Q169.
Answer: D

Q170.
Answer: B

Q171.
Answer: B

Q172.
Answer: B

Q173.
Answer: B

Q174.
Answer: C

Q175.
Answer: C

Q176.
Answer: A

Q177.

Answer: C

Q178.

Answer: D

Q179.

Answer: D

Q180.

Answer: C