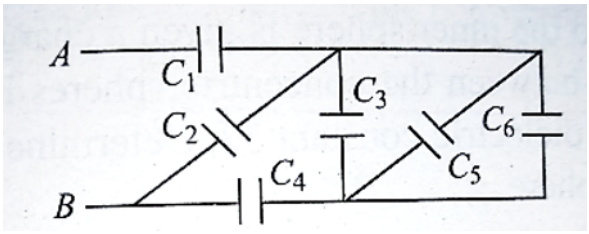
ICON Educational Institutions
JEE (Mains & Advanced) & NEET

Max Marks: 720 | **SR_WEEK-4 (06-07-2026)** | Time: 180 mins

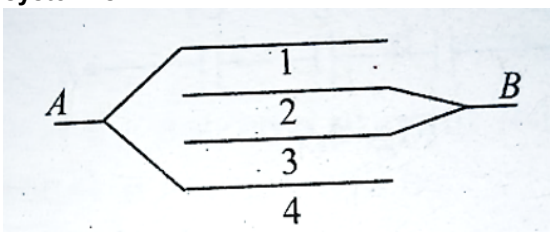
Physics

1. In the accompanying diagram, if $C_1 = 3\mu F, C_2 = 6\mu F, C_3 = 9\mu F, C_4 = 12\mu F, C_5 = 15\mu F$ and $C_6 = 18\mu F$, then the equivalent capacitance between the ends A and B is



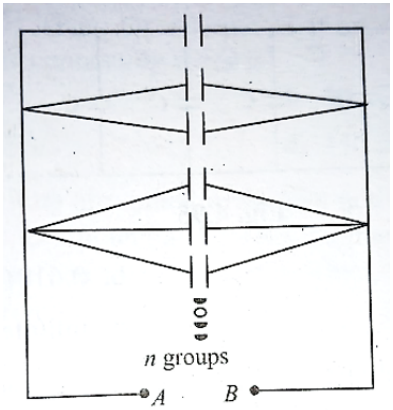
A) $1.22\mu F$ B) $5.16\mu F$
C) $2.25\mu F$ D) $2.51\mu F$

2. Four identical metal plates, each with a surface area A (on one side), are placed a distance d from each other as shown in Fig. The two inner plates are connected to point B and the other two plates to another point A. Then, the capacitance of the system is



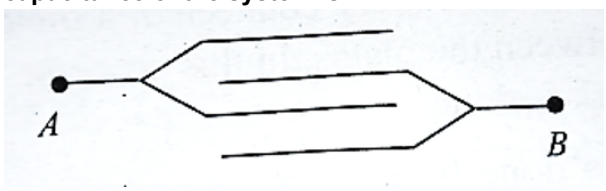
A) $\epsilon_0 A/d$ B) $2\epsilon_0 A/d$
C) $3\epsilon_0 A/d$ D) $2\epsilon_0 A/3d$

3. A number of capacitors, each of equal capacitance C, are arranged as shown in Fig. Equivalent capacitance between A and B is



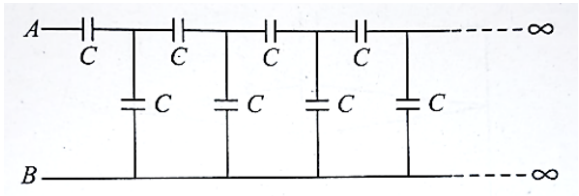
A) n^2C B) $(2n+1)C$
C) $\frac{(n-1)n}{2}C$ D) $\frac{(n+1)n}{2}C$

4. Four metallic plates, each with a surface area of one side A, are placed at a distance d from each other. The alternate plates are co nnected to points A and B as shown in Fig. Then the capacitance of the system is:



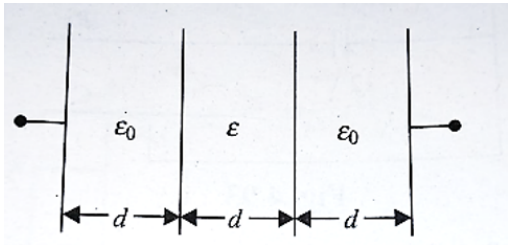
A) $\frac{\epsilon_0 A}{d}$ B) $\frac{2\epsilon_0 A}{d}$
C) $\frac{3\epsilon_0 A}{d}$ D) $\frac{4\epsilon_0 A}{d}$

5. The capacitance of an infinite circuit formed by the repetition of the same link consisting of two identical capacitors, each with capacitance C is



A) zero B) 0.618C
C) 2.62C D) infinite

6. For configuration of media of permittivity $\varepsilon_0, \varepsilon, \varepsilon_0$ between parallel plates each of area A, as shown in Fig, the equivalent capacitance is

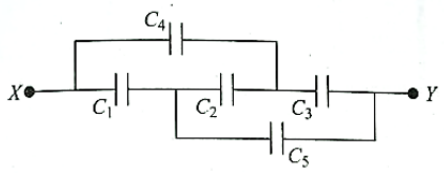


A) $\epsilon_0 A/d$ B) $\epsilon\epsilon_0 A/d$
C) $\frac{\epsilon\epsilon_0 A}{d(\epsilon+\epsilon_0)}$ D) $\frac{\epsilon\epsilon_0 A}{(2\epsilon+\epsilon_0)d}$

7. Two parallel plate capacitors of capacitances C and 2C are connected in parallel and charged to potential difference V. The battery is then disconnected and the region between the plates of C is filled completely with a material of dielectric constant K. The common potential difference across the combination becomes

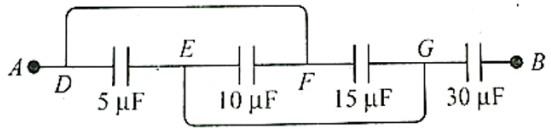
A) $\frac{2V}{K+2}$ B) $\frac{V}{K+2}$
C) $\frac{3V}{K+3}$ D) $\frac{3V}{K+2}$

8. The effective capacitance between points X and Y in Fig., assuming $C_2 = 10\mu F$ and that outer capacitors are all $4\mu F$ each, is



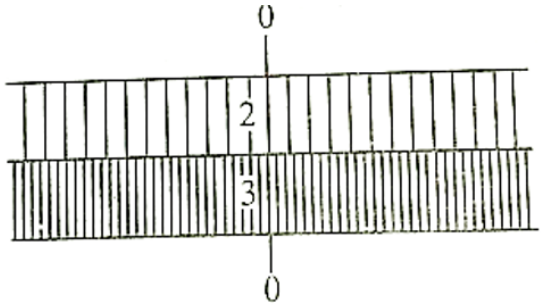
A) $1\mu F$ **B)** $3\mu F$
C) $4\mu F$ **D)** $5\mu F$

9. The resultant capacitance between the points A and B in Fig., is



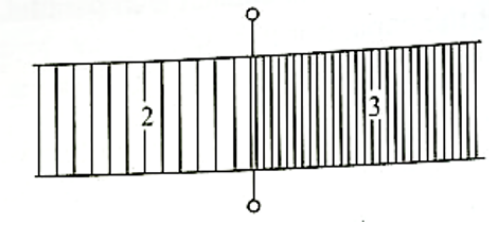
A) $15\mu F$ **B)** $30\mu F$
C) $60\mu F$ **D)** $45\mu F$

10. A parallel plate capacitor with no dielectric has a capacitance of $0.5\mu F$. The space between the plates is filled with equal amounts of two dielectric materials of dielectric constants 2 and 3 as shown in Fig. Find the capacitance of the system now.



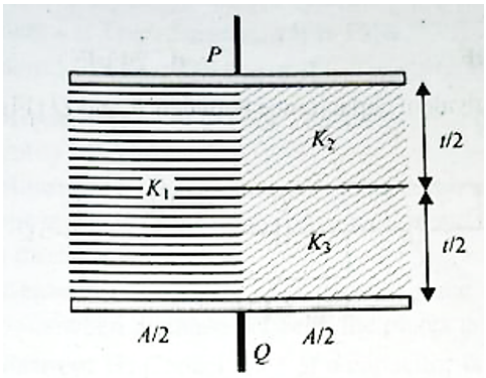
A) $1.2\mu F$ **B)** $1.8\mu F$
C) $1.25\mu F$ **D)** none of these

11. A parallel plate capacitor with no dielectric has a capacitance of $0.5\mu F$. The space between the plates is filled with equal amounts of two dielectric materials of dielectric constants 2 and 3 as shown in Fig. Find the capacitance of the system now.



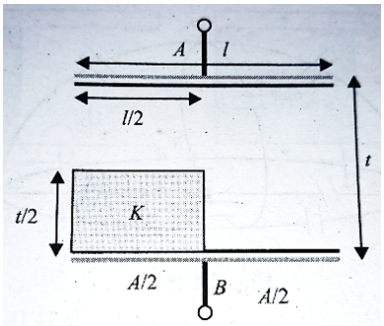
A) 1.2μF **B)** 1.25μF
C) 1.80μF **D)** None of these

12. A parallel plate capacitor is constructed using three different dielectric materials as shown in Fig. What is the capacitance across (P) and (Q)?



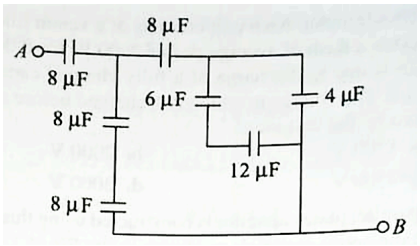
A) $\left(\frac{K_1}{2} + \frac{K_2K_3}{K_2+K_3}\right)\frac{\varepsilon_0 A}{t}$ **B)** $\left(K_1 + \frac{K_2K_3}{K_2+K_3}\right)\frac{\varepsilon_0 A}{t}$
C) $\left(K_1 + \frac{2K_2K_3}{K_2+K_3}\right)\frac{\varepsilon_0 A}{t}$ **D)** $\left(K_1 + \frac{K_2K_3}{2(K_2+K_3)}\right)\frac{\varepsilon_0 A}{t}$

13. Two square plates $(l \times l)$ and dielectric $\left(\frac{l}{2} \times \frac{t}{2} \times l\right)$ are arranged as shown in Fig. Find the equivalent capacitance of the structure.



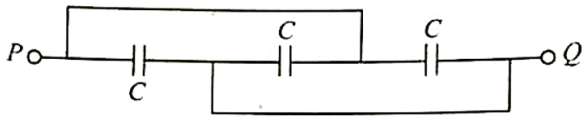
A) $\frac{2\varepsilon_0 A}{t}\left(\frac{K+1}{K+3}\right)$ **B)** B)$\frac{2\varepsilon_0 A}{t}\left(\frac{K+3}{K+1}\right)$
C) C)$\frac{\varepsilon_0 A}{t}\left(\frac{K+1}{K+3}\right)$ **D)** D)$\frac{\varepsilon_0 A}{t}\left(\frac{2K+1}{2K+3}\right)$

14. The equivalent capacitance across (AB) (Fig) is



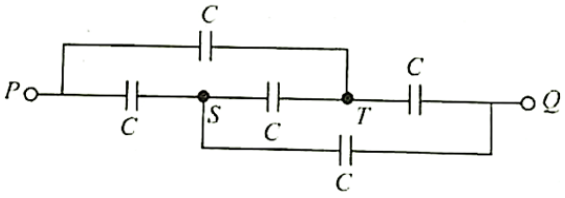
A) 8μF **B)** 12μF
C) 4μF **D)** 24μF

15. The equivalent capacitance between (P) and (Q) (Fig) is



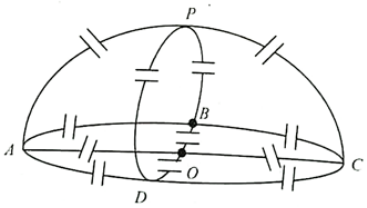
A) $\frac{C}{3}$ **B)** 3C
C) 2C **D)** C

16. The equivalent capacitance between (P) and (Q) (Fig) is



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

17. Find the capacitance between (P) and (O) (Fig).



A) 2C **B)** 3C
C) 8C **D)** 6C

18. A parallel plate capacitor is connected across a battery. Now, keeping the battery connected, a dielectric slab is inserted between the plates. In this process,

A) no work is done

B) work is done by the battery and the stored energy increases

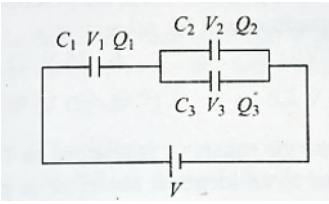
C) work is done by the external agent and the stored energy decreases

D) work is done by the battery as well as external agent but the stored energy does not change

19. A parallel plate capacitor has plates of area A and separation d and is charged to a potential difference V. The charging battery is then disconnected and the plates are pulled apart until their separation is 2d. What is the work required to separate the plates?

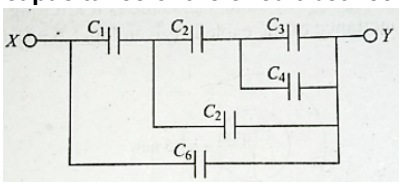
A) $2\varepsilon_0 AV^2/d$ **B)** $\varepsilon_0 AV^2/d$
C) $3\varepsilon_0 AV^2/2d$ **D)** $\varepsilon_0 AV^2/2d$

20. In Fig. three capacitors C_1, C_2 and C_3 are joined to a battery. With symbols having their usual meaning, the correct condition will be



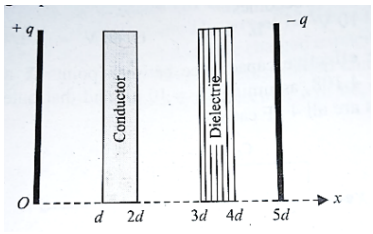
A) $Q_1 = Q_2 = Q_3$ and $V_1 = V_2 = V_3 + V$ **B)** $Q_1 = Q_2 + Q_3$ and $V = V_1 + V_2 + V_3$
C) $Q_1 = Q_2 + Q_3$ and $V = V_1 + V_2$ **D)** $Q_2 = Q_3$ and $V_2 = V_3$

21. In the given network of capacitors as shown in Fig., given $C_1 = C_2 = C_3 = 400\text{pF}$ and $C_4 = C_5 = C_6 = 200\text{pF}$. The effective capacitance of the circuit between X and Y is



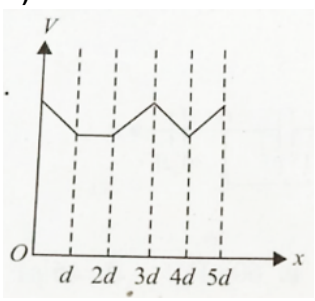
A) 810pF **B)** 205pF
C) 600pF **D)** 410pF

22. The distance between the plates of a parallel plate capacitor is 5d. The positively charged plate is at $x = 0$ and the negatively charged plate is at $x = 5d$.

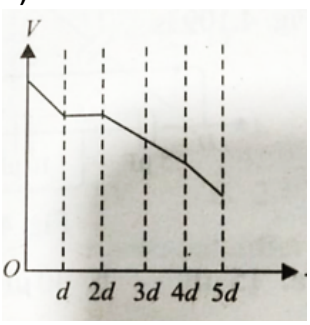


Two slabs, one of a conductor and the other of a dielectric of same thickness d, are inserted between the plates as shown in Fig. The potential V versus distance x graph will be

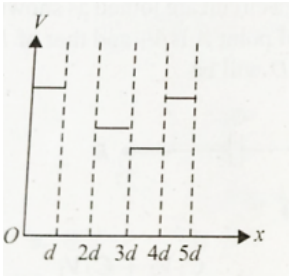
A)



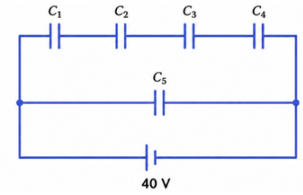
B)



C)



D) None of these

23. Five capacitors are connected across a $40\ \mathrm{V}$ battery as follows. Capacitors $C_1 = C_2 = C_3 = C_4 = 8\mu\mathrm{F}$ form a series loop branch between the battery terminals, while capacitor $C_5 = 4\mu\mathrm{F}$ is connected directly across the battery terminals (parallel to the series branch). 

Find the equivalent capacitance of the circuit and the charge stored on each capacitor.

A) $6\mu\mathrm{F}$, $80\mu\mathrm{C}$ on C_1, C_2, C_3, C_4 and $160\mu\mathrm{C}$ on C_5

B) $8\mu\mathrm{F}$, $160\mu\mathrm{C}$ on all capacitors

C) $4\mu\mathrm{F}$, $80\mu\mathrm{C}$ on all capacitors

D) $6\mu\mathrm{F}$, $160\mu\mathrm{C}$ on C_1, C_2, C_3, C_4 and $80\mu\mathrm{C}$ on C_5

24. Two identical capacitors each of capacitance $300\mathrm{pF}$ are initially uncharged. One capacitor is charged to a potential difference of $80\mathrm{V}$ using a battery and then disconnected. It is subsequently connected to the other uncharged capacitor with like plates joined together. The amount of electrostatic energy lost during the process is:

A) $4.8 \times 10^{-7}\mathrm{J}$

B) $9.6 \times 10^{-7}\mathrm{J}$

C) $2.4 \times 10^{-7}\mathrm{J}$

D) $1.2 \times 10^{-7}\mathrm{J}$

25. The plates of a parallel plate capacitor are separated by a distance d. Two dielectric slabs with dielectric constants K_1 and K_2 and thicknesses $\frac{d}{2}$ and $\frac{d}{4}$ respectively are inserted between the plates. The remaining space is air. The capacitance becomes 1.5 times the original capacitance. If $K_1 = 2K_2$, then the value of K_1 is:

A) 3.20

B) 2.40

C) 4.00

D) 2.00

26. A capacitor of capacitance $20\mathrm{pF}$ is connected across a battery of $40\mathrm{V}$. The electrostatic energy stored in the capacitor is:

A) $16\mathrm{nJ}$

B) $8\mathrm{nJ}$

C) $32\mathrm{nJ}$

D) $4\mathrm{nJ}$

27. The capacitance of a capacitor is determined mainly by:

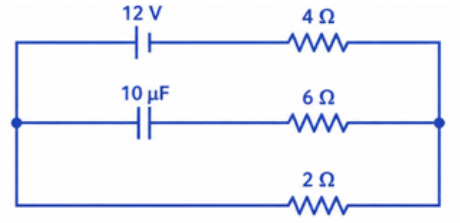
A) The current flowing through the capacitor

B) The amount of charge stored on the capacitor

C) The potential difference across the capacitor

D) The material and geometry of the capacitor

28. In the circuit shown below, a battery of $12\mathrm{V}$ is connected in the top branch in series with a 4Ω resistor. The middle branch contains a capacitor of capacitance x$10\mu\mathrm{F}$. in series with a 6Ω resistor, and the bottom branch contains a 2Ω resistor. All three branches are connected between the same two junctions. The steady-state current supplied by the battery is:



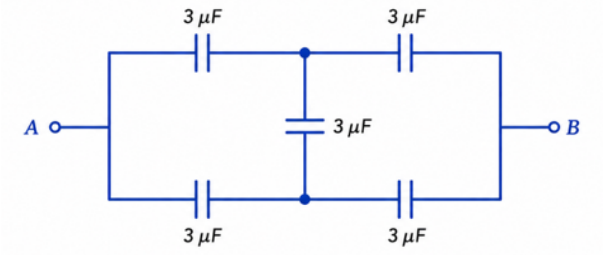
A) $4\mathrm{A}$

B) $3\mathrm{A}$

C) $2\mathrm{A}$

D) $1\mathrm{A}$

29. Five identical capacitors, each of capacitance $3\mu\mathrm{F}$, are connected between terminals A and B as follows. Two capacitors are connected in series in the upper branch, two capacitors are connected in series in the lower branch, and one capacitor is connected directly between the midpoints of the two series branches. The circuit is perfectly symmetrical. The equivalent capacitance between terminals A and B is:



A) $3\mu\mathrm{F}$

B) $1.5\mu\mathrm{F}$

C) $2\mu\mathrm{F}$

D) $4.5\mu\mathrm{F}$

30. A parallel plate capacitor remains connected to a battery. The distance between its plates is decreased while the dielectric medium remains unchanged. Consider the following statements. A. The capacitance increases. B. The potential difference across the capacitor remains constant. C. The charge stored on the capacitor increases. D. The electrostatic energy stored in the capacitor increases. E. The electric field between the plates remains unchanged. Choose the correct option.

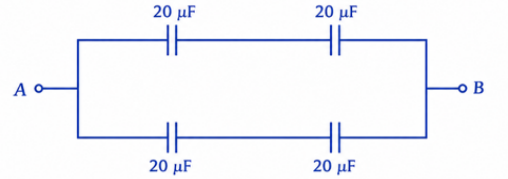
A) A, B, C and D only

B) A, C and E only

C) B, D and E only

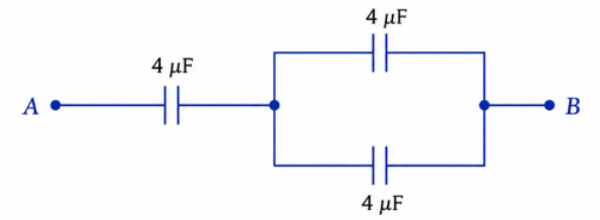
D) A, B and E only

31. Four identical capacitors, each of capacitance $20\mu\text{F}$, are connected as follows. Two capacitors are connected in series in the upper branch, while the remaining two capacitors are connected in series in the lower branch. These two series combinations are connected in parallel across terminals A and B. The equivalent capacitance between terminals A and B is:



A) $10\mu\text{F}$ **B)** $20\mu\text{F}$
C) $40\mu\text{F}$ **D)** $5\mu\text{F}$

32. Three identical capacitors, each of capacitance $4\mu\text{F}$, are connected as follows. One capacitor is connected in series with two identical capacitors connected in parallel between terminals A and B. The equivalent capacitance of the combination is:



A) $\frac{8}{3}\mu\text{F}$ **B)** $4\mu\text{F}$
C) $6\mu\text{F}$ **D)** $2\mu\text{F}$

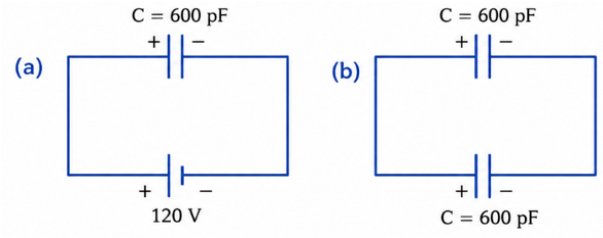
33. The separation between the plates of a parallel plate capacitor is reduced to one-third of its original value, while the area of each plate is doubled. If the initial capacitance is C, then the final capacitance is:

A) 3C **B)** 6C
C) $\frac{2C}{3}$ **D)** $\frac{C}{6}$

34. The equivalent capacitance of two capacitors is $2\mu\text{F}$ when connected in series and $18\mu\text{F}$ when connected in parallel. The values of the two capacitors are:

A) $9\mu\text{F}, 9\mu\text{F}$ **B)** $15\mu\text{F}, 3\mu\text{F}$
C) $(9+3\sqrt{5})\mu\text{F}$ and $(9-3\sqrt{5})\mu\text{F}$ **D)** $10\mu\text{F}, 8\mu\text{F}$

35. A capacitor of capacitance 600pF is fully charged by a 120V battery. It is then disconnected from the battery and connected to an identical uncharged capacitor with like plates connected together. The electrostatic energy stored in the system after redistribution of charge is:

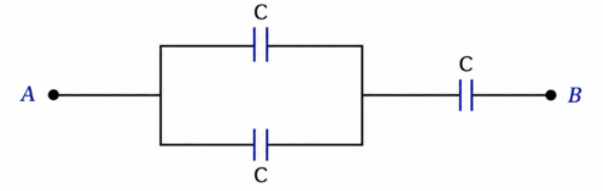


A) $2.16 \times 10^{-6}\text{J}$ **B)** $4.32 \times 10^{-6}\text{J}$
C) $1.08 \times 10^{-6}\text{J}$ **D)** $5.40 \times 10^{-6}\text{J}$

36. A parallel plate capacitor has a uniform electric field of magnitude E between its plates. If the volume between the plates is V, then the electrostatic energy stored in the capacitor is:

A) $\frac{1}{2}\varepsilon_0 EV$ **B)** $\varepsilon_0 E^2 V$
C) $\frac{E^2 V}{2\varepsilon_0}$ **D)** $\frac{1}{2}\varepsilon_0 E^2 V$

37. Three identical capacitors, each of capacitance C, are connected between terminals A and B as follows. Two capacitors are connected in parallel, and this parallel combination is connected in series with the third capacitor. The equivalent capacitance between A and B is:



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

38. The capacitance of a parallel plate capacitor with air between the plates is $8\mu\text{F}$. When the space between the plates is completely filled with a dielectric material, the capacitance becomes $32\mu\text{F}$. If $\varepsilon_0 = 8.85 \times 10^{-12}\text{C}^2\text{N}^{-1}\text{m}^{-2}$, the permittivity of the dielectric material is:

A) $7.08 \times 10^{-11}\text{C}^2\text{N}^{-1}\text{m}^{-2}$ **B)** $8.85 \times 10^{-12}\text{C}^2\text{N}^{-1}\text{m}^{-2}$
C) $1.77 \times 10^{-11}\text{C}^2\text{N}^{-1}\text{m}^{-2}$ **D)** $3.54 \times 10^{-11}\text{C}^2\text{N}^{-1}\text{m}^{-2}$

39. A capacitor of capacitance $15\mu\text{F}$ is connected to a voltage source whose potential difference is increasing at the rate of $4, \text{V/s}$. The conduction current through the connecting wires and the displacement current between the capacitor plates are, respectively:

A) $0, 60\mu\text{A}$ **B)** $60\mu\text{A}, 60\mu\text{A}$
C) $60\mu\text{A}, 0$ **D)** 0,0

40. An isolated parallel plate capacitor has plate area A and carries a fixed charge Q. If the area of each plate is doubled while the charge remains unchanged, the electrostatic force between the plates will:

A) Increase by a factor of 2 **B)** Remain unchanged

C) Become half of its initial value **D)** Become one-fourth of its initial value

41. A capacitor is charged to a potential difference V by a battery and then disconnected from it. An identical uncharged capacitor is connected in parallel with the charged capacitor. The total electrostatic energy stored in the system after charge redistribution is:

A) $\frac{CV^2}{8}$ **B)** $\frac{CV^2}{2}$

C) CV^2 **D)** $\frac{CV^2}{4}$

42. A parallel plate air capacitor has capacitance C, plate separation d, and is connected to a battery of potential difference V. The electrostatic force of attraction between the plates is:

A) $\frac{CV^2}{4d}$ **B)** $\frac{CV^2}{2d}$

C) $\frac{CV^2}{d}$ **D)** $\frac{C^2V^2}{2d}$

43. Two isolated parallel metal plates carrying charges $+Q$ and $-Q$ are separated by a fixed distance. The space between the plates is completely filled with a dielectric of dielectric constant K. The electric potential difference between the plates will:

A) Decrease to $\frac{V}{K}$ **B)** Remain unchanged

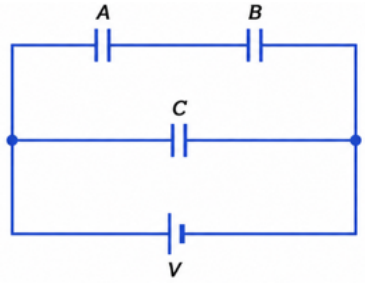
C) Increase to KV **D)** Become zero

44. A series combination of n_1 capacitors, each of capacitance C, is connected across a potential difference of 6V. Another parallel combination of n_2 capacitors, each of capacitance C_x, is connected across a potential difference of 3V. If both combinations store the same total energy, then the value of C_x in terms of C is

A) $\frac{4C}{n_1n_2}$ **B)** $\frac{2C}{n_1n_2}$

C) $\frac{6C}{n_1n_2}$ **D)** $\frac{8C}{n_1n_2}$

45. Three identical capacitors A, B and C, each of capacitance C, are connected across a battery of voltage V such that capacitors A and B are connected in series, and this series combination is connected in parallel with capacitor C. If the energy stored in capacitor A is U_A and the total energy stored in the circuit is U_T, then the ratio $\frac{U_A}{U_T}$ is:

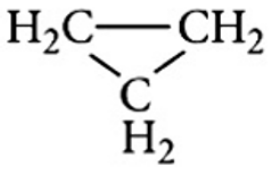


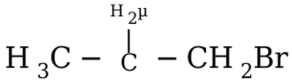
A) $\frac{1}{6}$ **B)** $\frac{1}{3}$

C) $\frac{1}{2}$ **D)** $\frac{2}{3}$

Chemistry

46. Which of the following compounds shall not produce propene by reaction with HBr followed by elimination or direct only elimination reaction?

A)  **B)** $H_3C - C - CH_2OH$

C) $H_2C = C = O$ **D)** 

47. 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

48. Consider the nitration of benzene using mixed conc. H_2SO_4 and HNO_3. If a large amount of $KHSO_4$ is added to the mixture, the rate of nitration will be

A) unchanged **B)** doubled

C) faster **D)** slower

49. 2,3-Dimethyl-2-butene can be prepared by heating which of the following compounds with a strong acid?

A) $(CH_3)_3C - CH = CH_2$ **B)** $(CH_3)_2C = CH - CH_2 - CH_3$

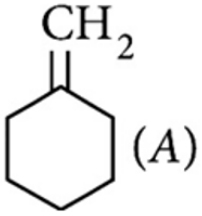
C) $(CH_3)_2CH - CH_2 - CH(CH_3)_2$ **D)** $(CH_3)_2CH - CH(CH_3) - CH$

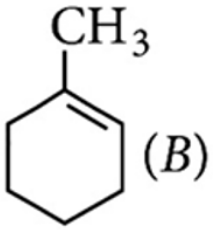
50. Which of the following can be used as the halide component for Friedel-Crafts reaction?

A) Chlorobenzene **B)** Bromobenzene

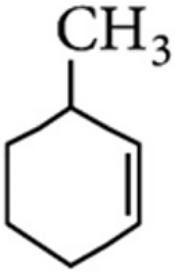
C) Chloroethene **D)** Isopropyl chloride

51. In the reaction with HCl, an alkene reacts in accordance with the Markovnikov's rule to give a product 1-chloro-1-methylcyclohexane. The possible alkene is

A) 

B) 

C) (A) and (B)

D) 

52. Identify Z in the sequence of reactions:

$$CH_3CH_2CH = CH_2 \xrightarrow{HBr/H_2O_2} Y \xrightarrow{C_2H_5ONa} Z$$

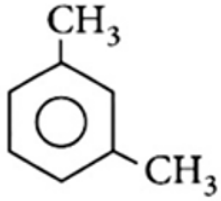
A) $CH_3 - (CH_2)_3 - O - CH_2CH_3$

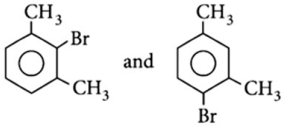
B) $(CH_3)_2CH - O - CH_2CH_3$

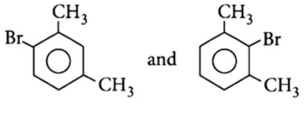
C) $CH_3(CH_2)_4 - O - CH_3$

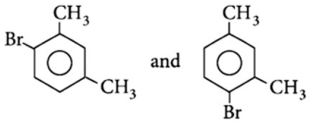
D) $CH_3(CH_2) - CH(CH_3) - O - CH_2CH_3$

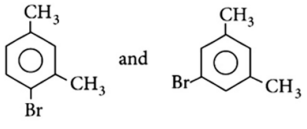
53. What products are formed when m-Xylene is treated with Br_2 in the presence of $FeBr_3$?



A) 

B) 

C) 

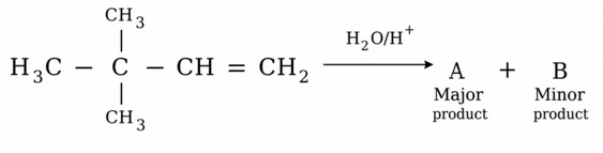
D) 

54. Which of the following compounds will not undergo Friedel-Craft's reaction easily

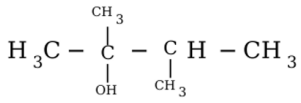
A) Nitrobenzene **B)** Toluene

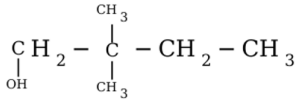
C) Cumene **D)** Xylene

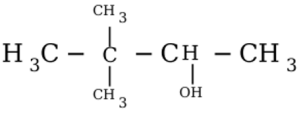
55. In the following reaction

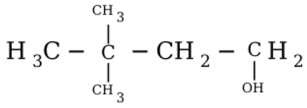


. The major product is

A) 

B) 

C) 

D) 

56. 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

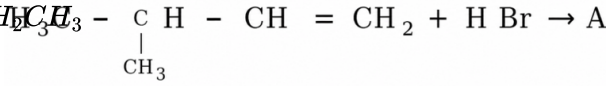
C) X - o- and p-chlorotoluene, Y = Trichloromethyl benzene

D) X = Benzyl chloride, Y = m-chlorotoluene

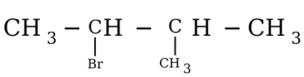
57. Benzene reacts with CH_3Cl in the presence of anhydrous $AlCl_3$, to form

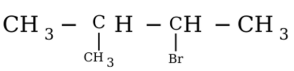
A) chlorobenzene **B)** benzyl chloride

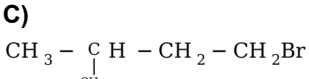
C) xylene **D)** toluene

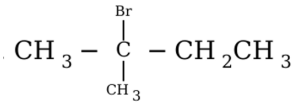
58. 

A (predominantly) is

A) 

B) 

C) 

D) 

59. Reaction of HBr with propene in the presence of peroxide gives

A) isopropyl bromide **B)** 3-bromopropane

C) allyl bromide **D)** n-propyl bromide

60. In preparation of alkene from alcohol using Al_2O_3, which is the effective factor?

A) Porosity of Al_2O_3 **B)** Temperature

C) Concentration **D)** Surface area of Al_2O_3

61. 2-Bromopentane is heated with potassium ethoxide in ethanol. The major product obtained is

A) trans-2-pentene **B)** 1-pentene

C) 2-ethoxy pentane **D)** 2-cis-pentene

62. The reaction,
$CH_2 = CH - CH_3 + HBr \rightarrow CH_3 - CHBr - CH_3$
is

A) electrophilic substitution **B)** free radical addition
C) nucleophilic addition **D)** electrophilic addition

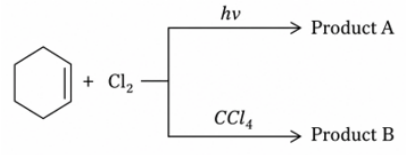
63. One of the following which does not observe the anti-Markownikoff's addition of HBr, is

A) pent-2-ene **B)** propene
C) but-2-ene **D)** but-1-ene

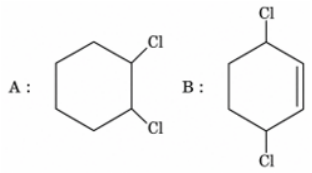
64. $R - CH_2 - CCl_2 - R \xrightarrow{Reagent} R - C \equiv C - R.$
The reagent is

A) Na **B)** HCl in H_2O
C) KOH in C_2H_5OH **D)** Znin alcohol

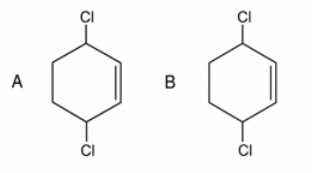
65. Identify product A and product B



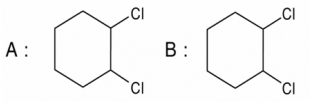
A)



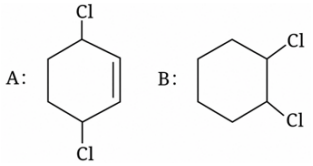
B)



C)



D)

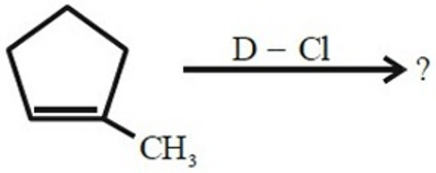


66. The product (C) in the below mentioned reaction is:

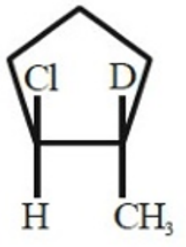
$$CH_3 - CH_2 - CH_2 - Br \xrightarrow[\Delta]{KOH(alc)} A \xrightarrow{HBr} B \xrightarrow[KOH(aq)]{\Delta} C$$

A) Propan-1-ol **B)** Propene
C) Propyne **D)** Propan-2-ol

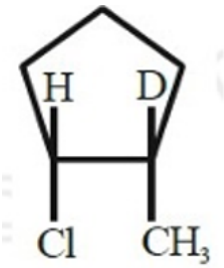
67. Major product of the following reaction is:



A)

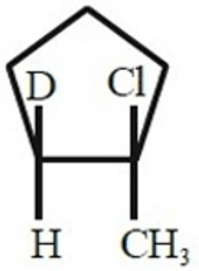


B)

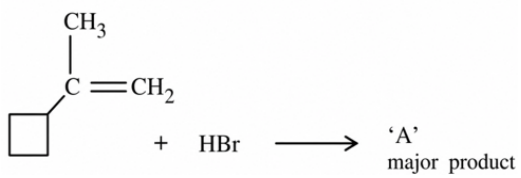


C)

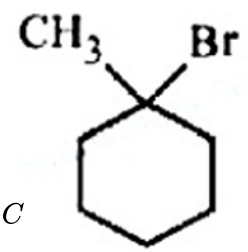
D)



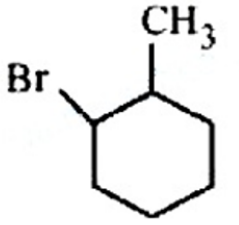
68. In the following given reaction ' A ' is:



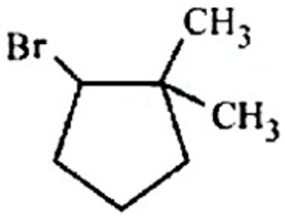
A)



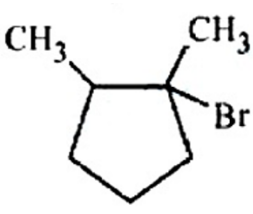
B)



C)



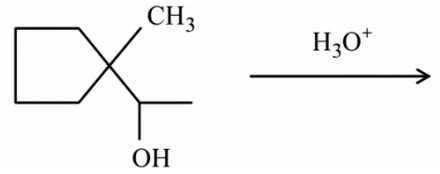
D)



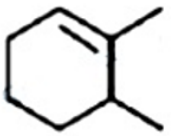
69. The one giving maximum number of isomeric alkenes on dehydrohalogenation reaction is (excluding rearrangement)

A) 1-Bromo-2-methylbutane **B)** 2-Bromopropane
C) 2-Bromopentane **D)** 2-Bromo-3,3-dimethylpentane

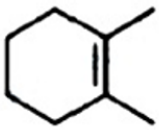
70. The major products ' A ' and ' B ', respectively, are:



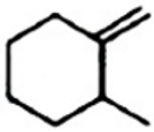
A)



B)



C)

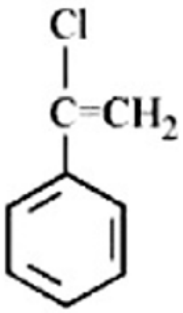


D)

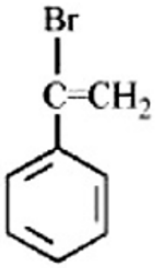
71. Product 'A' of following sequence of reactions is:

Ethylbenzene $A \xrightarrow[(b)Cl_2,\Delta \\ (c)alc.KOH]{(a)Br_2,Fe} A \; Major\ \text{Pr}oduct$

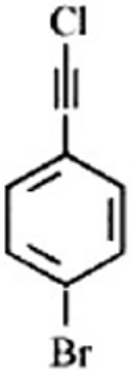
A)



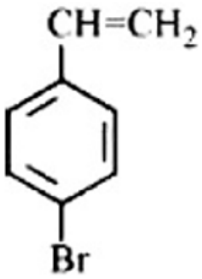
B)



C)



D)



72. The correct sequence of reagents used in the preparation of 4-bromo-2-nitroethylbenzene from benzene is:

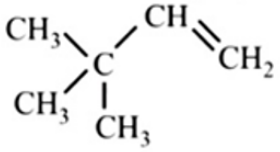
A) $CH_3COCl/AlCl_3, Br_2/AlBr_3, HNO_3/H_2SO_4, Zn-Hg/HCl$

B) $CH_3COCl/AlCl_3, HNO_3/H_2SO_4, Br_2/AlBr_3, Zn-Hg/HCl$

C) $Br_2/AlBr_3, CH_3COCl/AlCl_3, HNO_3/H_2SO_4, Zn-Hg/HCl$

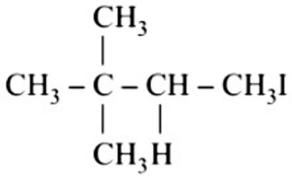
D) $HNO_3/H_2SO_4, Br_2/AlBr_3, Zn-Hg/HCl, CH_3COCl/AlCl_3$

73. What is the major product formed by HI on

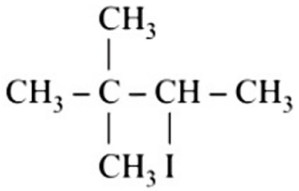


reaction with

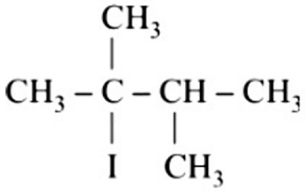
A)



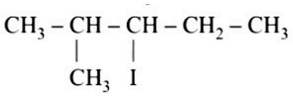
B)



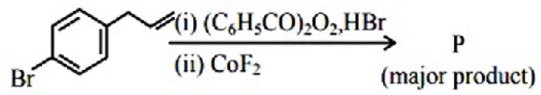
C)



D)

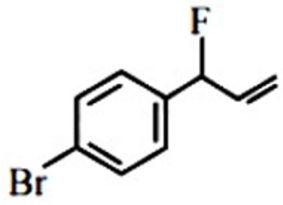


74.

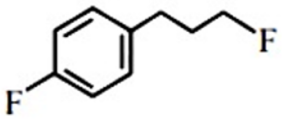


Major product P of above reaction, is :

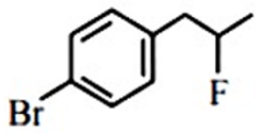
A)



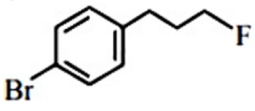
B)



C)



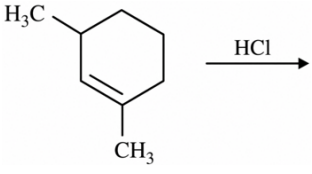
D)



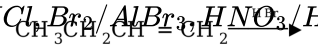
75. Which of the following reactions will not produce a racemic product?

A)

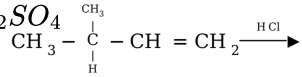
B)



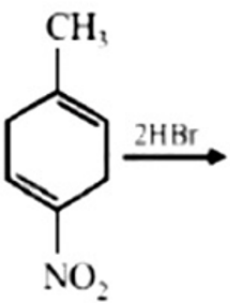
C)



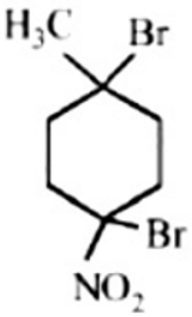
D)



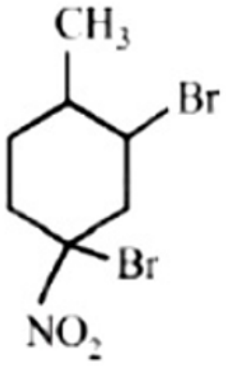
76. The major product of the following reaction is:



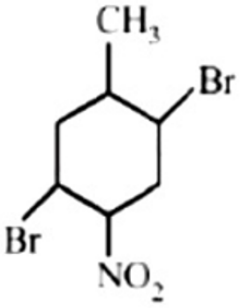
A)



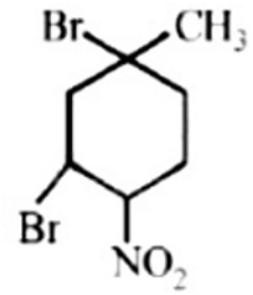
B)



C)



D)



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

$CH_3CH = CHCH(CH_3)_2 + HBr \rightarrow$

A) $CH_3CH(Br)CH_2CH(CH_3)_2$

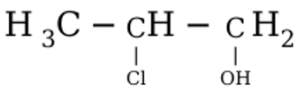
B) $CH_3CH_2CH(Br)CH(CH_3)_2$

C) $Br(CH_2)_3CH(CH_3)_2$

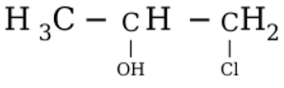
D) $CH_3CH_2CH_2C(Br)(CH_3)_2$

78. The major product of the following addition reaction is: $H_3 - C - CH = CH_2 \xrightarrow{Cl_2/H_2O}$

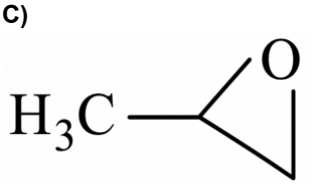
A)



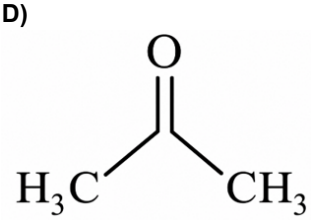
B)



C)



D)

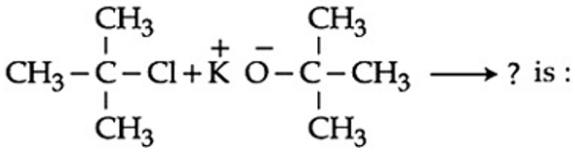


79. Which one of the following alkenes when treated with HCl yields majorly an anti-Markovnikov product?

A) $CH_3O - CH = CH_2$ **B)** $Cl - CH = CH_2$

C) $H_2N - CH = CH_2$ **D)** $F_3C - CH = CH_2$

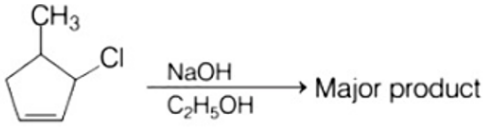
80. The major product in the reaction:



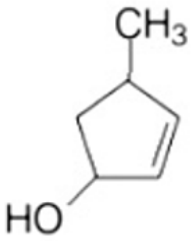
A) t-Butyl ethyl ether **B)** 2,2-Dimethyl butane

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

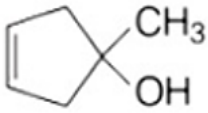
81. The major product of the following reaction is:



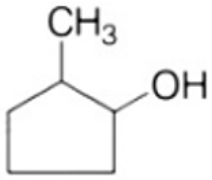
A)



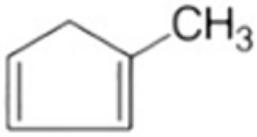
B)



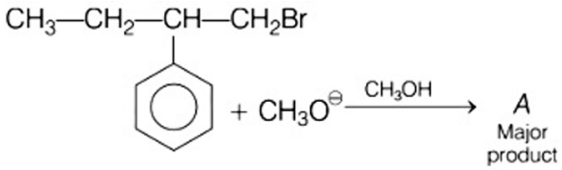
C)



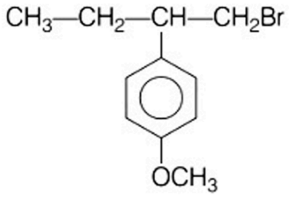
D)



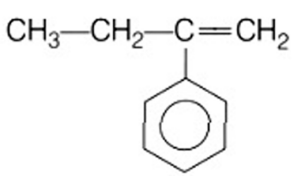
82. The major product (A) formed in the reaction given below is:



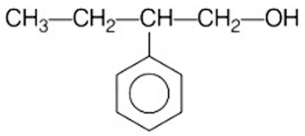
A)



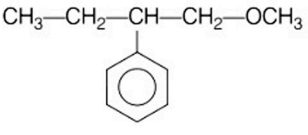
B)



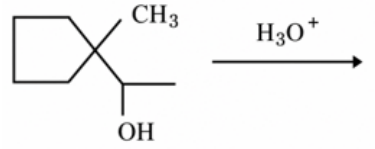
C)



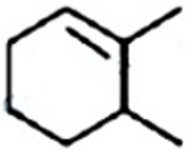
D)



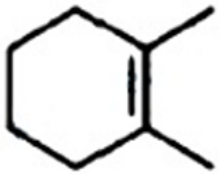
83. Find out the major product for the following reaction.



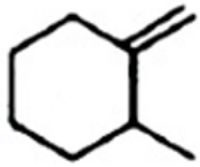
A)



B)

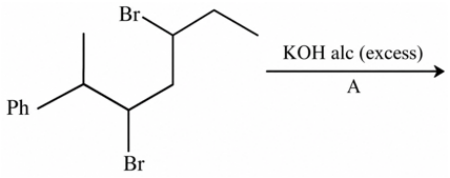


C)

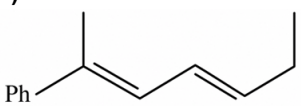


D)

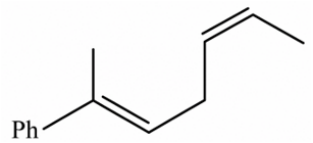
84. The major product of the following reaction is:



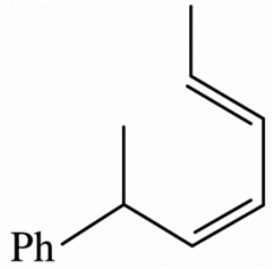
A)



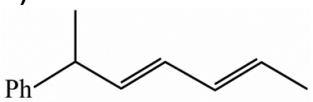
B)



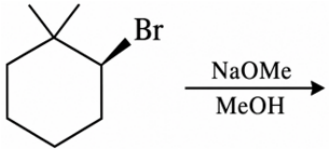
C)



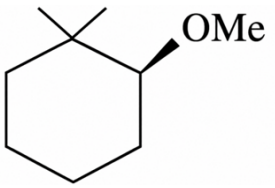
D)



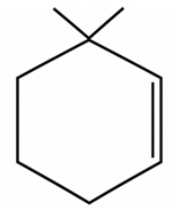
85. The major product of the following reaction is:



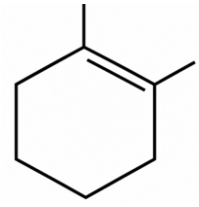
A)



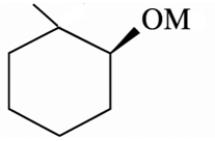
B)



C)



D)



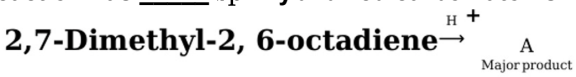
86. The total number of alkenes possible by dehydrobromination of 3-bromo-3-cyclopentylhexane using alcoholic KOH is:

A) 5 **B)** 6
C) 9 **D)** 10

87. 3-Methylhex-2-ene on reaction with HBrin presence of peroxide forms an addition product (A). The number of possible stereoisomers for 'A' is_____

A) 8 **B)** 4
C) 9 **D)** 2

88. The major product 'A' of the following given reaction has _____ sp^2 hybridized carbon atoms.

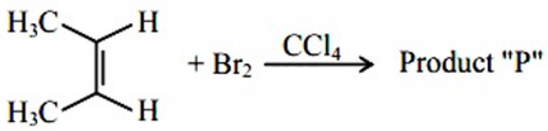


A) 2 **B)** 9
C) 1 **D)** 8

89. In the presence of sunlight, benzene reacts with Cl_2 to give product, X. The number of hydrogens in X is _____.

A) 1 **B)** 19
C) 9 **D)** 6

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



A) 5 **B)** 2
C) 3 **D)** 1

Botany

91. Match the terms in Column I with their description in Column II and choose the correct option:

Column I	Column II
A. Dominance	i. Many genes affect one phenotype
B. Incomplete dominance	ii. In a heterozygous organism only one allele expresses itself
C. Pleiotropy	iii. Heterozygous offspring show an intermediate character
D. Polygenic inheritance	iv. A single gene produces more than one effect

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

92. A polygenic trait is controlled by 4 pairs of genes. What will be the number of unique gametes produced by an organism that is fully heterozygous for all 4 pairs?

A) 8 **B)** 9
C) 16 **D)** 64

93. Assertion (A): Polygenic inheritance is also known as quantitative inheritance. Reason (R): In polygenic inheritance, the intensity of the phenotype depends directly on the number of dominant alleles present.

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

94. In a typical Mendelian dihybrid cross, what is the probability of obtaining an F2 offspring that is homozygous dominant for one trait and homozygous recessive for the other trait?

A) 1/16 **B)** 2/16
C) 4/16 **D)** 9/16

95. In a polygenic cross for skin color involving 3 gene pairs (A, B, C), an individual with the genotype AaBbCc marries an individual with the genotype aabbcc. What is the probability of getting a child with a completely dark phenotype (AABBCC)?

A) $1/8$ **B)** $1/64$
C) 0 **D)** $1/16$

96. In the F2 generation of a Mendelian dihybrid cross, how many unique genotypes are possible, and out of those, how many show a completely heterozygous condition (AaBb)?

A) 9 genotypes, 4 are completely heterozygous **B)** 4 genotypes, 2 are completely heterozygous
C) 16 genotypes, 4 are completely heterozygous **D)** 9 genotypes, 1 is completely heterozygous

97. A total of 1600 seeds are collected from the F2 generation of a dihybrid cross involving stem height and seed shape in pea plants. How many seeds are expected to be heterozygous tall and wrinkled?

A) 100 **B)** 200
C) 300 **D)** 400

98. In a dihybrid cross for seed color (Yellow/Green) and seed shape (Round/Wrinkled), what fraction of the total F2 generation plants will be homozygous for at least one trait?

A) $4/16$ **B)** $8/16$
C) $12/16$ **D)** $14/16$

99. If an F1 dihybrid plant with the genotype AaBb is self-pollinated, what is the probability that an F2 offspring chosen at random will have the exact same genotype as its parent?

A) $1/4$ **B)** $1/8$
C) $1/16$ **D)** $9/16$

100.
Mendel's Law of Independent Assortment holds true for genes that are located on:

A) Non-homologous chromosomes only **B)** Same chromosome close to each other
C) Homologous chromosomes or far apart on the same chromosome **D)** Sex chromosomes only

101.
Which specific stage of cell division serves as the physical basis for Mendel's Law of Independent Assortment?

A) Metaphase I of Meiosis **B)** Anaphase I of Meiosis
C) Anaphase II of Meiosis **D)** Prophase I of Meiosis

102.
If independent assortment is occurring perfectly, what is the expected frequency of parental combinations versus recombinant combinations in a typical dihybrid test cross?

A) 75% parental, 25% recombinant **B)** 25% parental, 75% recombinant
C) 50% parental, 50% recombinant **D)** 100% parental, 0% recombinant

103.
Which phenomenon acts as a direct deviation or exception to Mendel's Law of Independent Assortment?

A) Incomplete dominance **B)** Linkage
C) Codominance **D)** Pleiotropy

104.
Assertion (A): Genes located far apart on the same chromosome can still show independent assortment. Reason (R): Closely located genes on a chromosome have a higher chance of undergoing crossing over during meiosis.

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

105.
Which of the following human diseases is a classic example of pleiotropy?

A) Phenylketonuria (PKU) **B)** Color blindness
C) Haemophilia **D)** Thalassemia

106.
In garden pea plants (Pisum sativum), a single gene controls starch grain size and seed shape. A cross between homozygous large-grained round seeds (BB) and homozygous small-grained wrinkled seeds (bb) produces F1 plants (Bb). What will be the phenotype of the F1 plants?

A) Large starch grains and round seeds
B) Intermediate starch grains and round seeds
C) Small starch grains and wrinkled seeds
D) Intermediate starch grains and wrinkled seeds

107.
In mice, a pleiotropic allele for yellow coat color (Y) is dominant over the wild-type agouti color (y). However, the allele Y is also a recessive lethal allele causing embryonic death when homozygous (YY). If two yellow mice are crossed, what phenotypic ratio will be observed among the surviving offspring?

A) $3:1$
B) $1:2:1$
C) $2:1$
D) $9:3:3:1$

108.
Assertion (A): Sickle cell anaemia is a classic example of a pleiotropic gene disorder in humans. Reason (R): A single point mutation in the gene coding for the alpha-globin chain of haemoglobin results in multiple symptoms like anaemia, organ damage, and pain crises.

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

109.
The term "linkage" was coined by which scientist, and which experimental organism did they use to prove it?

A) Gregor Mendel; Pisum sativum
B) Thomas Hunt Morgan; Drosophila melanogaster
C) Henking; Pyrrhocoris
D) Sutton and Boveri; Grasshopper

110.
When two genes are present very close to each other on the same chromosome, they tend to be inherited together. This phenomenon leads to:

A) A higher frequency of recombinant phenotypes in the F2 generation
B) A higher frequency of parental phenotypes in the F2 generation
C) A perfect 9:3:3:1 phenotypic ratio
D) Control of a single trait by multiple alleles

111.
The recombination frequencies between four linked genes are as follows: A and B = 8%, B and C = 15%, A and C = 23%, A and D = 3%, B and D = 5%. What is the correct linear sequence of these genes on the chromosome?

A) A — B — C — D
B) D — A — B — C
C) A — D — B — C
D) B — D — A — C

112.
Assertion (A): The maximum possible recombination frequency between any two linked genes on a single chromosome is 50%. Reason (R): Crossing over during meiosis occurs at the four-strand stage, involving only two of the four chromatids at any single crossover event.

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

113.
Who experimentally verified the Chromosomal Theory of Inheritance, proving that genes reside on chromosomes?

A) Walter Sutton and Theodore Boveri
B) Gregor Mendel
C) Thomas Hunt Morgan
D) Hugo de Vries

114.
Which of the following properties is common to both genes and chromosomes according to the Chromosomal Theory of Inheritance?

A) They occur in pairs in diploid cells
B) They segregate at the time of gamete formation
C) Independent pairs assort independently of each other
D) All of the above.

115.
Why did T.H. Morgan select Drosophila melanogaster (fruit flies) to validate the Chromosomal Theory of Inheritance?

A) They could be grown easily on simple synthetic medium in the laboratory
B) A single mating could produce a large number of progeny flies
C) They have a very short life cycle of about two weeks
D) All of the above.

116.

Assertion (A): The pairing and separation of a pair of chromosomes leads to the segregation of a pair of factors they carried. Reason (R): Mendelian factors (genes) are physically located on the chromosomes.

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

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

C) (A) is true but (R) is false

D) Both (A) and (R) are false.

117.

Match the biological milestones in Column I with the scientists who achieved them in Column II, and choose the correct option

Column I	Column II
A. Parallelism between genes and chromosomes	**i.** Thomas Hunt Morgan
B. Experimental proof of chromosomal theory	**ii.** Henking
C. term linkage	**iii.** Walter Sutton and Theodore Boveri
D. First genetic map construction	**iv.** Alfred Sturtevant

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

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

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

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

118.

Assertion (A): The number of linkage groups in an organism is always equal to its haploid number of chromosomes. Reason (R): All the genes present on a single chromosome are physically linked and form one linkage group.

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

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

C) (A) is true but (R) is false

D) (A) is false but (R) is true.

119.

Which of the following graphs correctly represents the relationship between the physical distance between two genes on a chromosome and their recombination frequency?

A) A straight linear line that increases infinitely

B) A line that increases linearly at first and then plateaus horizontally at (50%)

C) A line that decreases linearly down to (0%)

D) A perfect bell-shaped curve.

120.

Alfred Sturtevant used the frequency of recombination between gene pairs on the same chromosome as a measure of the distance between genes and 'mapped' their position on the chromosome. He defined one map unit as:

A) 100% recombination between two genes

B) 10% recombination between two genes

C) 1% recombination between two genes

D) 0.1% recombination between two genes

121.

Statement 1: Map unit distances between genes are strictly additive only over short chromosomal segments. Statement 2: As the physical distance between two genes increases, the likelihood of multiple crossover events occurring between them increases, which masks true recombinants.

A) Both statement 1 and statement 2 are true

B) Both statement 1 and statement 2 are false

C) statement 1 is true but statement 2 is false

D) statement 1 is false but statement 2 is true

122.

When a continuous phenotypic trait is studied across a large, random human population and plotted on a graph, it typically yields a symmetrical bell-shaped curve. The peak (middle) of this curve represents which group of individuals?

A) Individuals with the maximum number of dominant alleles

B) Individuals with the minimum number of dominant alleles

C) Individuals with an intermediate number of dominant alleles

D) Individuals carrying only lethal mutations

123.

Consider the following statements regarding a standard Mendelian dihybrid F2 generation: Statement I: The phenotypic ratio of 9:3:3:1 implies that all four combinations are produced in equal genotypic frequencies. Statement II: Out of the 16 combinations in the Punnett square, exactly 4 genotypes are completely homozygous.

A) Both Statement I and Statement II are correct

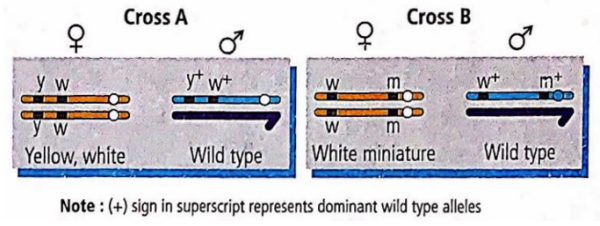
B) Both Statement I and Statement II are incorrect

C) Statement I is correct but Statement II is incorrect

D) Statement I is incorrect but Statement II is correct.

124.

Refer to the given figure of cross A and cross B and select the correct statement regarding them.



Note : (+) sign in superscript represents dominant wild type alleles

A) In cross A, the strength of linkage between genes y and w is higher than the cross B genes w and m

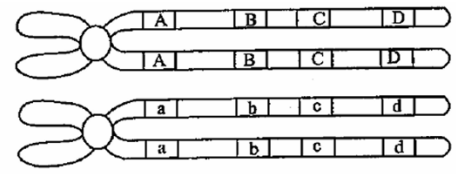
B) In cross A, the strength of linkage between genes y and w is lesser than the cross B genes w and m

C) Both cross A genes y and w and cross B genes w and m have the same strength of linkage

D) The percentage of recombinants produced in cross A is higher than cross B.

125.

Given diagram shows a pair of homologous chromosomes during meiosis.



Maximum crossing over will occur between genes:

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

126.

Mendel law of independent assortment does not hold true for the genes that are located closely on:

A) Same chromosome
B) Non homologous chromosome
C) X chromosome
D) Autosome

127.

Chromosome maps/ genetic maps were first prepared by:

A) Sutton and Boveri (1902)
B) Bateson and Punnett (1906)
C) Morgan (1910)
D) Sturtevant (1911).

128.

In a dihybrid cross between two heterozygotes $AaBb \times AaBb$, if we get 3: 1 ratio among the offsprings, the reason for this may be:

A) poly gene
B) Linked genes
C) Pleiotropic gene
D) Complementary gene

129.

Linkage can be best studied by the result of a:

A) Monohybrid test cross
B) Dihybrid test cross
C) Monohybrid reciprocal cross
D) All of the above

130.

Which of the following statements is true about all genes located on the same chromosome?

A) They form different groups depending upon their relative distance
B) They form one linkage group
C) They will not form any linkage group
D) They form interactive groups that affect the phenotype

131.

In a dihybrid test cross, a researcher observes 83% parental combinations and 17% recombinant combinations among the offspring. What is the genetic distance between the two genes?

A) 83 map units
B) 17 map units
C) 50 map units
D) 34 map units

132.

Which of the following is NOT a reason why Morgan chose Drosophila melanogaster for his experiments?

A) They can be grown easily on a simple synthetic medium in the lab.
B) A single mating could produce a large number of progeny flies.
C) They have a long life span of about 3–4 months.
D) There was a clear differentiation of the sexes (male and female).

133.

During his experiments with Drosophila, Morgan noticed that when two genes in a dihybrid cross were situated on the same chromosome:

A) The proportion of parental gene combinations was much lower than non-parental types.
B) The proportion of parental gene combinations was much higher than non-parental types.
C) The genes segregated completely independently according to a 9:3:3:1 ratio.
D) Recombinant types always accounted for exactly 50% of the offspring.

134.

Consider the following statements regarding Morgan's experimental crosses: Statement I: Cross A (between yellow-bodied, white-eyed females and brown-bodied, red-eyed males) showed tight linkage with only 37.2% recombination. Statement II: Cross B (between white-eyed, miniature-winged females and red-eyed, normal-winged males) showed loose linkage with 1.3% recombination.

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

135.

Assertion (A): Phenylketonuria is a genetic disorder that is considered a prime example of pleiotropy. Reason (R): The single gene mutation in PKU manifests as mental retardation, decreased pigmentation of skin, and hair reduction.

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

Zoology

136.
Hardness of the bones is due to

A) hard matrix made up of calcium salts
B) hard matrix made up of phosphates
C) hard matrix made up of sodium salts
D) hard matrix made up of chelates

137.
Cartilage has pliable matrix due to the presence of

A) chondroitin salts
B) osteoblast
C) chondroblast
D) osteoclast

138.
Which of the following is not a function of the skeletal system?

A) Production of erythrocytes
B) Storage of minerals
C) Production of body heat
D) Locomotion

139.
A U-shaped bone present at the base of buccal cavity is

A) ethmoid bone
B) malleus
C) hyoid bone
D) lacrimal bone

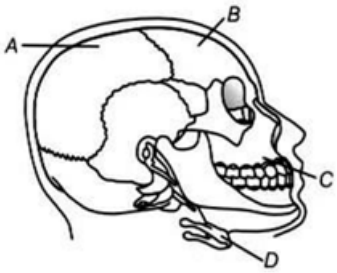
140.
Find out the correct order of number of bones in the human skull (i.e. cranial bone, facial bone, hyoid bone and middle ear bone, respectively).

A) 14, 8, 1 and 3
B) 6, 8, 14 and 1
C) 14, 8, 3 and 1
D) 8, 14, 1 and 6

141.
Middle ear contains three tiny bones. I. Maxillae II. Malleus III. Incus IV. Stapes V. Vomer

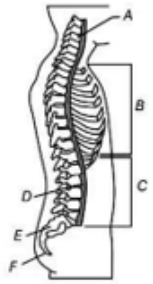
A) I, II and III
B) II, III and IV
C) III, IV and V
D) I, II and V

142.
Identify A, B, C and D in the given diagram of human skull, choose the correct option.



A) A–Hyoid bone, B–Maxilla, C–Frontal bone, D–Parietal bone
B) A–Hyoid bone, B–Maxilla, C–Parietal bone, D–Frontal bone
C) A–Maxilla, B–Hyoid bone, C–Parietal bone, D–Frontal bone
D) A–Parietal bone, B–Frontal bone, C–Maxilla, D–Hyoid bone

143.
Examine the figure of vertebral column (right lateral view) and identify A, B, C, D, E and F.



A) A-Lumbar vertebrae, B-Thoracic vertebrae, C-Cervical vertebrae, D-Intervertebral disc, E-Sacrum, F-Coccyx
B) A-Cervical vertebrae, B-Thoracic vertebrae, C-Lumbar vertebrae, D-Intervertebral disc, E-Sacrum, F-Coccyx
C) A-Thoracic vertebrae, B-Cervical vertebrae, C-Intervertebral disc, D-Lumbar vertebrae, E-Coccyx, F-Sacrum
D) A-Cervical vertebrae, B-Thoracic vertebrae, C-Lumbar vertebrae, D-Intervertebral disc, E-Coccyx, F-Sacrum

144.
Fused vertebrae in human are I. Sacral II. Coccygeal III. Thoracic IV. Cervical V. Lumbar

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

145.
Flat bone on the ventral midline of thorax to which ribs are attached is

A) coccyx
B) sternum
C) sacrum
D) ribs

146.
Out of 'X' pairs of ribs in humans only 'Y' pairs are true ribs. Select the option that correctly represents values of X and Y and provides their explanation.

A) $X = 12, Y = 7$ — True ribs are attached dorsally to vertebral column and ventrally to the sternum.
B) $X = 12, Y = 5$ — True ribs are attached dorsally to vertebral column and sternum on the two ends.
C) $X = 24, Y = 7$ — True ribs are attached dorsally to vertebral column, but are free on ventral side.
D) $X = 24, Y = 12$ — True ribs are attached dorsally to vertebral column, but are free on ventral side.

147.
False ribs are ventrally attached to

A) sternum through hyaline cartilage
B) seventh rib through hyaline cartilage
C) seventh rib through fibrous cartilage
D) sternum through fibrous cartilage

148.
Each human limb is made of

A) 60 bones
B) 50 bones
C) 40 bones
D) 30 bones

149.
Number of tarsals, metatarsals and phalanges in the hindlimbs of human are

A) 7, 5, 14
B) 8, 5, 14
C) 9, 5, 14
D) 5, 6, 7

150.
A cup-shaped bone that covers the knee ventrally is called

A) stapes
B) patella
C) malleus
D) incus

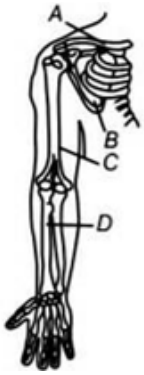
151.
The triangular bone scapula is found on

A) dorsal part of thorax between 2nd and 7th ribs
B) ventral part of thorax between 2nd and 7th ribs
C) medial part of thorax between 2nd and 7th ribs
D) None of the above

152.
Cavity in coxal bone called acetabulum is formed by the fusion of

A) ilium and incus
B) ilium and ischium
C) incus and ischium
D) ilium, ischium and pubis

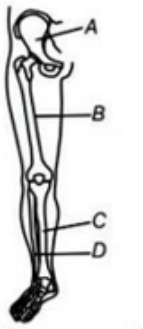
153.
Examine the figure of right pectoral girdle and forelimb and identify the parts labelled as A, B, C



and D

A) A-Clavicle, B-Scapula, C-Humerus, D-Radius
B) A-Scapula, B-Femur, C-Ulna, D-Tarsals
C) A-Clavicle, B-Femur, C-Radius, D-Carpals
D) A-Clavicle, B-Humerus, C-Ulna, D-Tarsals

154.
Identify the parts labelled as A, B, C and D in the given figure of right pelvic girdle and lower limb



bone.

A) A-Coxal bone, B-Femur, C-Tibia, D-Fibula
B) A-Femur, B-Coxal bone, C-Tibia, D-Fibula
C) A-Fibula, B-Tibia, C-Coxal bone, D-Femur
D) A-Femur, B-Fibula, C-Tibia, D-Coxal bone

155.
Pelvic girdle consists of two coxal bones and each coxal bone consists I. Ilium II. Incus III. Ischium IV. Pubis Choose the correct option containing all correct bones.

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

156.
A cricket player is fast chasing a ball in the field. Which one of the following groups of bones is directly contributing to this movement?

A) Malleus, tibia, metatarsals, femur
B) Pelvis, patella, tarsals, incus
C) Sternum, femur, tibia, fibula
D) Tarsals, femur, metatarsals, tibia

157.
The pivot joint between atlas and axis is a type of

A) fibrous joint
B) cartilaginous joint
C) synovial joint
D) saddle joint

158.
The characteristics and an example of a synovial joint in humans is

	Characteristics	Examples
(a)	Fluid cartilage between two bones, limited movements	Knee joints
(b)	Fluid-filled between two joints provides cushion	Skull bones
(c)	Fluid-filled synovial cavity between two bones	Joint between atlas and axis
(d)	Lymph-filled between two bones, limited movement	Gliding joint between carpals

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

159.
Identify the synovial joints among the given options. I. Ball and socket II. Hinge joint III. Pivot joints IV. Sutures of skull V. Vertebral joints Select the correct option.

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

160.
Choose the incorrect pair.

A) Facial bones – Made up of 14 skeletal elements
B) Sacral vertebrae – One and fused
C) Vertebrochondral ribs – False ribs (8th, 9th, 10th)
D) Hinge joint – Adjacent lumbar vertebrae

161.
Select the correct matching of the type of the joint with the example in human skeletal system.

	Types of Joint	Examples
(a)	Cartilaginous joint	Between frontal and parietal
(b)	Pivot joint	Between 3rd and 4th cervical vertebrae
(c)	Hinge joint	Between humerus and pectoral girdle
(d)	Gliding joint	Between carpals

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

162.
The joint of humerus with pectoral girdle is

A) hinge joint
B) pivot joint
C) non-movable joint
D) ball and socket joint

163.
Where is the saddle joint present in humans?

A) Between carpals and metacarpals of thumb
B) Between atlas and axis
C) Between radius and ulna
D) Between carpals and phalanges

164.
Which of the following diseases is an autoimmune disorder?

A) Myasthenia gravis
B) Arthritis
C) Osteoporosis
D) Gout

165.
Which of the following muscular disorders is inherited?

A) Muscular dystrophy
B) Myasthenia gravis
C) Botulism
D) Tetany

166.
Lack of relaxation between successive stimuli in sustained muscle contraction is known as

A) fatigue
B) tetanus
C) tonus
D) spasm

167.
Gout is caused due to the accumulation of

A) glucose
B) uric acid crystals
C) bile
D) ammonia

168.
Choose the correct statement(s).

A) Axial skeleton comprises 80 bones
B) Skull, vertebral column, sternum and ribs constitute the axial skeleton
C) Skull has total 22 bones in cranial and facial region
D) All of the above

169.
Select the incorrect statement.

A) Each half of pectoral girdle consists of a clavicle and scapula
B) Acromion is a flat, expanded process of ischium containing glenoid cavity
C) Clavicle is a long slender bone with two curvatures
D) Force generated by muscles results in locomotion through joints and thus, they act as fulcrum

170.
Select the correct statement regarding the specific disorder of muscular or skeletal system.

A) Muscular dystrophy – Age related shortening of muscles
B) Osteoporosis – Decrease in bone mass and higher chances of fractures with advancing age
C) Myasthenia gravis – Autoimmune disorder which inhibits sliding of myosin filaments
D) Gout – Inflammation of joints due to extra deposition of calcium

171.
Select the correct statement with respect to locomotion in humans.

A) A decreased level of progesterone causes osteoporosis in old people
B) Accumulation of uric acid crystals in joints causes their inflammation
C) The vertebral column has 10 thoracic vertebrae
D) The joint between adjacent vertebrae is a fibrous joint

172.
Match the following columns.

Column I (Ribs)	Column II (Number in pairs)
A. True ribs	1. 11, 12 pairs
B. False ribs	2. 8, 9, 10 pairs
C. Floating ribs	3. First 7 pairs

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

173.
Match the following columns.

Column I (Limb bones)	Column II (Number)
A. Ulna	1. 14 bones
B. Carpals	2. 5 bones
C. Metacarpals	3. 8 bones
D. Phalanges	4. 1 bone

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

174.
Match the following columns.

Column I	Column II
A. Flat bones	1. Collar bone
B. Irregular bones	2. Vertebrae
C. Glenoid cavity	3. Shoulder joint
D. Clavicle	4. Ear ossicles

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

175.
Match the following columns.

Column I (Location)	Column II (Bones)
A. Hand	1. Femur
B. Wrist	2. Radius
C. Thigh	3. Carpal
D. Ankle	4. Tarsals

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

176.
Match the following columns.

Column I (Types of vertebrae)	Column II (Number)
A. Cervical vertebrae	1. 1
B. Thoracic vertebrae	2. 1
C. Lumbar vertebrae	3. 5
D. Sacral vertebrae	4. 12
E. Caudal vertebrae	5. 7

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

177.
Match the following columns.

Column I (Joints)	Column II (Location)
A. Fibrous joints	1. Adjacent vertebrae
B. Cartilaginous joints	2. Pubic symphysis
C. Fibrous cartilaginous joint	3. Sutures

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

178.

Match the following columns.

Column I (Bones)	Column II (Number)
A. Tarsals	1. 5 in number
B. Metatarsals	2. 8 in number
C. Phalanges	3. 14 in number
D. Carpals	4. 7 in number

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

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

179.

Match the following joints with the bones involved.

Column I	Column II
A. Gliding joint	1. Between carpals and metacarpal of thumb
B. Hinge joint	2. Between atlas and axis
C. Pivot joint	3. Between the carpals
D. Saddle joint	4. Between humerus and ulna

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

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

180.

Match the following columns.

Column I (Disorders)	Column II (Features)
A. Myasthenia gravis	1. Degeneration of skeletal muscles
B. Muscular dystrophy	2. Neuromuscular junction affected
C. Tetany	3. Low Ca^{2+} in body fluid
D. Arthritis	4. Inflammation of joints

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

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

ANSWER KEY

Physics

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

Chemistry

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

Botany

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

Zoology

136.	**1**	137.	**1**	138.	**3**	139.	**3**

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

SOLUTIONS

Q1.

Answer: D

Explanation:

C_3, C_5 and C_6 are in parallel and C_4 is in series with it. Then C_2 is in parallel and C_1 is in series.

Q2.

Answer: B

Explanation:

Plate 2 and 3 will be at same potential. So, there will be two capacitors in parallel.

Q3.

Answer: D

Explanation:

$$C_{\text{eq}} = C + 2C + 3C + \cdots + nC = \frac{(n+1)n}{2}C$$

Q4.

Answer: C

Explanation:

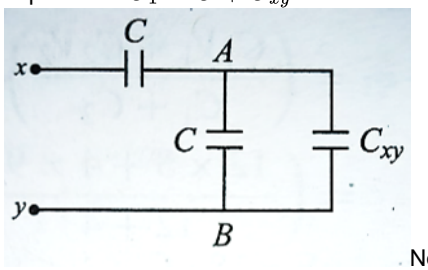
The four plates are alternately connected. They form three capacitors in parallel. Capacity of each capacitor is $\frac{\varepsilon_0 A}{d}$. So, the net capacity is $\frac{3\varepsilon_0 A}{d}$.

Q5.

Answer: B

Explanation:

As $\infty \pm 1 = \infty$ Therefore, if one link is reduced or added to the circuit, the capacitance remains unchanged. If $C_{xy}$is equivalent capacitance between (x) and (y), then the equivalent circuit is shown in figure. The capacitances$C_{xy}$and C connected between (A) and (B) are in parallel. Their effective capacitance$C_1 = C + C_{xy}$.



Now, C (connected between (x) and (A)) and$C_1$are in series. Therefore, effective capacitance between (x) and (y) is$C_{xy} = \frac{CC_1}{C+C_1}$. Hence, $C_{xy} = \frac{C(C+C_{xy})}{C+C+(C_{xy})}$. Solving for C_{xy}, we get $C_{xy} = \frac{\sqrt{5}-1}{2}\,C = 0.618C$

Q6.

Answer: D

Explanation:

$C_{\text{eq}} = \frac{\varepsilon_0 A}{\frac{d}{K_1}+\frac{d}{K_2}+\frac{d}{K_3}}$ Here, $K_1 = K_3 = 1, \qquad K_2 = \frac{\varepsilon}{\varepsilon_0}$.

Q7.

Answer: D

Explanation:

$V_C = \frac{Q_1+Q_2}{C_1+C_2} = \frac{CV+2CV}{KC+2C} = \frac{3V}{K+2}$.

Q8.

Answer: C

Explanation:

Wheatstone's bridge will be formed

Q9.

Answer: A

Explanation:

$5\mu\text{F}, 10, mu\text{F}, 15\mu\text{F}$ will be in parallel, then $30\mu\text{F}$ will be in series.

Q10.

Answer: A

Explanation:

$C = \frac{\varepsilon_0 A}{d} = 0.5$ New capacitance

$$C' = \frac{\varepsilon_0 A}{\frac{d/2}{2}+\frac{d/2}{3}} = \frac{\varepsilon_0 A}{d}\left[\frac{1}{\frac{1}{4}+\frac{1}{6}}\right]$$

$C' = C \times 2.4 = 1.2\mu\text{F}$

Q11.

Answer: B

Explanation:

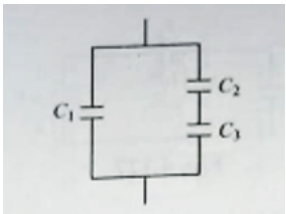
$C' = \frac{2\varepsilon_0 A/2}{d} + \frac{3\varepsilon_0 A/2}{d} = C\left[1+\frac{3}{2}\right] = \frac{5}{2} \times 0.5 = 1.25\mu\text{F}$

Q12.

Answer: A

Explanation:

$C_1 = \frac{K_1\varepsilon_0 A/2}{t}\; C_2 = \frac{K_2\varepsilon_0 A/2}{t/2}\; C_3 = \frac{K_3\varepsilon_0 A/2}{t/2}$ Now, $C_{\text{eq}} = C_1 + \frac{C_2 C_3}{C_2+C_3}$.

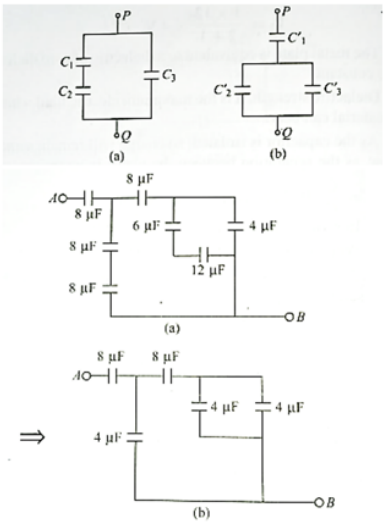


Q13.

Answer: A

Explanation:

We can make equivalent circuit of given system in two ways as in Fig. (a) and (b).

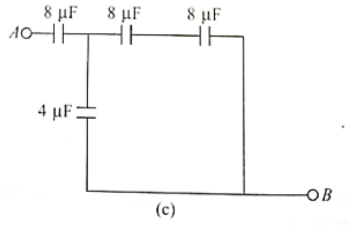


Q14.

Answer: C

Explanation:

Using the method of successive reduction (see Fig).

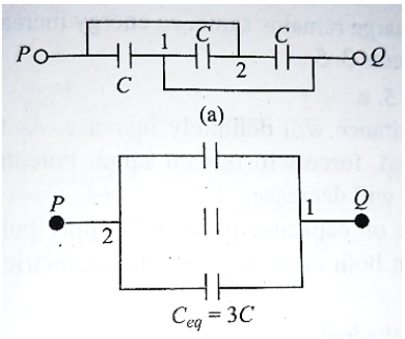


Q15.

Answer: B

Explanation:

Using the method of successive reduction (see fig)

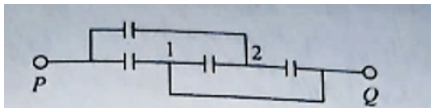


Q16.

Answer: B

Explanation:

The circuit given in fig., can be changed to the structure shown in fig

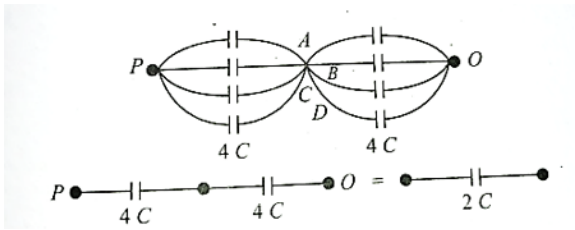


Q17.

Answer: A

Explanation:

A, B, C and D are equipotential points (see fig)



Q18.

Answer: B

Explanation:
Extra charge will flow through battery, so work is done by battery. External agent will don negative work

Q19.

Answer: D

Explanation:
$W = U_2 - U_1 = \frac{q^2}{2}\left[\frac{1}{C_2} - \frac{1}{C_1}\right]$
$C_1 = \frac{\varepsilon_0 A}{d}, C_2 = \frac{C_1}{2} = \frac{\varepsilon_0 A}{2d}\ q = C_1 V = \frac{\varepsilon_0 AV}{d}$
Solve to get, $W = \frac{1}{2}\frac{\varepsilon_0 AV^2}{d}$

Q20.

Answer: C

Explanation:

At junction $A,\ Q_1$ will divide into Q_2 and Q_3. Hence,
$Q_1 = Q_2 + Q_3$.
C_2 and C_3 are in parallel, so potential on them will be same.
$V_2 = V_3$ V will divide into V_1 and V_2 (or V_3)
Hence, $V = V_1 + V_2$ or $V = V_1 + V_3$

Q21.

Answer: D

Explanation:

Start with C_3 and C_4 in parallel, then C_2 in series, then C_5 in parallel, then C_1 in series and finally C_6 is in parallel.

Q22.

Answer: B

Explanation:

Electric field is the $-ve$ of slope of $V - x$ graph. Inside the conductor, electric field is zero, so slope of $V - x$ graph is zero. Inside dielectric, field is decreases, so slope decreases

Q23.

Answer: A

Explanation:

The four identical capacitors are connected in series, so their equivalent capacitance is obtained using the reciprocal formula. This series combination is in parallel with C_5, so the total capacitance is the sum of the two branch capacitances. The charge in a series branch is the same on every capacitor, while the parallel capacitor has the full battery voltage across it.

Q24.

Answer: C

Explanation:
Initially, only one capacitor stores energy. When it is connected to an identical uncharged capacitor, charge is equally shared, making the final voltage half of the initial voltage. The final electrostatic energy becomes half of the initial energy. Hence, the energy lost equals half of the initial stored energy.

Q25.

Answer: B

Explanation:
The dielectric slabs and the remaining air layer behave like capacitors connected in series along the thickness of the capacitor. The effective separation is obtained by dividing each dielectric thickness by its dielectric constant. Using the given capacitance ratio and the relation between the dielectric constants, the value of K_1 is calculated.

Q26.

Answer: A

Explanation:

The electrostatic energy stored in a capacitor is calculated using $U = \frac{1}{2}CV^2$. Substitute the given capacitance and voltage, then convert the answer into nanojoules.

Q27.

Answer: D

Explanation:
The capacitance of a capacitor depends only on its physical construction, namely the geometry of the plates and the dielectric material between them. It does not depend on the charge stored or the potential difference applied.

Q28.

Answer: C

Explanation:

In the steady state, the capacitor behaves as an open circuit. Therefore, no current flows through the middle branch. The only conducting path consists of the 4Ω and 2Ω resistors in series with the battery.

Q29.

Answer: A

Explanation:

Since the circuit is perfectly symmetrical, the two midpoint junctions are at the same potential. Therefore, no charge flows through the middle capacitor, making it ineffective. The circuit reduces to two identical series combinations connected in parallel.

Q30.

Answer: A

Explanation:

When a capacitor is connected to a battery, the battery keeps the voltage constant. Reducing the plate separation increases the capacitance. Since $Q = CV$, the charge also increases. The stored energy, $U = \frac{1}{2}CV^2$, also increases because the voltage remains constant. The electric field changes because $E = \frac{V}{d}$, and decreasing d increases the electric field.

Q31.

Answer: B

Explanation:

Each branch consists of two identical capacitors in series, giving an equivalent capacitance of $10\mu\text{F}$. Since the two branches are connected in parallel, their capacitances add to give the total equivalent capacitance.

Q32.

Answer: A

Explanation:

First combine the two parallel capacitors. Then calculate the equivalent capacitance of the resulting capacitor in series with the remaining capacitor using the series formula.

Q33.

Answer: B

Explanation:
The capacitance of a parallel plate capacitor is directly proportional to the plate area and inversely proportional to the separation between the plates. $C = \frac{\varepsilon A}{d}$ After changing the area and plate separation, substitute the new values into the formula and compare with the original capacitance.

Q34.

Answer: C

Explanation:

For two capacitors, $C_P = C_1 + C_2$ and $C_S = \frac{C_1 C_2}{C_1 + C_2}$. Using the given series and parallel capacitances, determine the sum and product of the two capacitances, then solve the quadratic equation.

Q35.

Answer: A

Explanation:

Initially, only one capacitor stores energy. After connecting it to an identical uncharged capacitor, the total charge remains constant and is shared equally. Hence, the final voltage becomes half of the initial voltage. The final energy stored in the system is calculated using the total capacitance after connection.

Q36.

Answer: D

Explanation:
The energy stored in an electric field is equal to the energy density multiplied by the volume occupied by the field. The energy density of a uniform electric field in free space is $u = \frac{1}{2}\varepsilon_0 E^2$. Hence, $U = uV$.

Q37.

Answer: B

Explanation:

First combine the two capacitors in parallel. Then combine the resulting equivalent capacitor in series with the remaining capacitor using the series capacitance formula.

Q38.

Answer: D

Explanation:
The dielectric constant is the ratio of the capacitance with dielectric to the capacitance with air. $K = \frac{C}{C_0}$ The permittivity of the dielectric is $\varepsilon = K\varepsilon_0$.

Q39.

Answer: B

Explanation:
The conduction current in the wires is $I = C\frac{dV}{dt}$. According to Maxwell's displacement current concept, the displacement current between the capacitor plates is equal to the conduction current in the external circuit.

Q40.

Answer: C

Explanation:
For an isolated capacitor, the charge remains constant. The electrostatic force between the plates is $F = \frac{Q^2}{2\varepsilon_0 A}$. Thus, the force is inversely proportional to the plate area. Doubling the plate area reduces the force to one-half.

Q41.

Answer: D

Explanation:
Initially, only one capacitor stores energy. After connecting an identical uncharged capacitor in parallel, the total charge remains constant and is shared equally. The final voltage becomes half of the initial voltage, and the total energy stored becomes half of the initial energy.

Q42.

Answer: B

Explanation:
The electrostatic force between the plates of a capacitor connected to a constant voltage source is obtained from the rate of change of electrostatic energy with respect to the plate separation. The required formula is $F = \frac{CV^2}{2d}$.

Q43.

Answer: A

Explanation:
Since the capacitor is isolated, the charge on the plates remains constant. Introducing a dielectric reduces the electric field by a factor ofK. As the plate separation remains unchanged, the potential difference also decreases by the same factor.

Q44.

Answer: A

Explanation:
The equivalent capacitance of capacitors in series is reduced, while in parallel it increases. Equate the total energies stored in both combinations using the formula $U = \frac{1}{2}CV^2$ and solve for the unknown capacitance.

Q45.

Answer: A

Explanation:

The two capacitors in series share the battery voltage equally because they are identical. The parallel capacitor gets the full battery voltage. Calculate the energy stored in capacitor A and divide it by the total energy stored in all capacitors.

Q46.

Answer: C

Explanation:

Ketene ($H_2C = C = O$) is a unique molecule that reacts withHBrto form an acyl bromide or an enol intermediate that tautomerizes to an acetyl halide. Unlike the other options, it does not possess the three-carbon alkyl skeleton required to form propene through standard elimination or substitution-elimination pathways.

Q47.

Answer: B

Explanation:
In the free-radical chlorination of alkanes, chlorine atoms replace hydrogen atoms. The number of possible monochloro products depends on the number of non-equivalent hydrogen types in the molecule. Neopentane is highly symmetrical, with all 12 of its hydrogen atoms being chemically equivalent, resulting in a single possible monochloro product.

Q48.

Answer: D

Explanation:
The nitration of benzene involves the formation of the nitronium ion (NO_2^+) as the active electrophile. The addition of $KHSO_4$ increases the concentration of bisulfate ions (HSO_4^-) in the solution. According to Le Chatelier's principle, an increase in the concentration of a product shifts the equilibrium backward, reducing the amount of NO_2^+ available and slowing the reaction.

Q49.

Answer: A

Explanation:
Heating 3,3-dimethyl-1-butene with a strong acid leads to the formation of a secondary carbocation, which then undergoes a 1,2-methyl shift to form a more stable tertiary carbocation. Subsequent deprotonation yields the most substituted and stable alkene, 2,3-dimethyl-2-butene.

Q50.

Answer: D

Explanation:
Friedel-Crafts alkylation requires an alkyl halide that can easily form a carbocation or a polarized complex. Aryl halides (like chlorobenzene) and vinyl halides (like chloroethene) are unreactive in this reaction because the $C-X$ bond has partial double bond character due to resonance between the halogen's lone pair and the π system, making it very strong and difficult to break.

Q51.

Answer: C

Explanation:

Both methylenecyclohexane (exocyclic double bond) and 1-methylcyclohexene (endocyclic double bond) produce the same tertiary carbocation intermediate upon protonation according to Markovnikov's rule. Reaction of this intermediate with Cl^- yields the identical product: 1-chloro-1-methylcyclohexane.

Q52.

Answer: A

Explanation:
The first step is the addition of HBr to but-1-ene in the presence of peroxide, which follows the anti-Markovnikov rule to yield 1-bromobutane. The second step is a Williamson ether synthesis where the ethoxide ion displaces the bromide to form an ether.

Q53.

Answer: C

Explanation:

Methyl groups are ortho/para directing and activating. In m-xylene (1,3-dimethylbenzene), the position between the two methyl groups (carbon-2) is highly sterically hindered, so substitution is avoided there. Bromination occurs at the other activated positions (4 and 6), which are equivalent but lead to the major and minor observed isomers depending on the specific crowding at the time of attack.

Q54.

Answer: A

Explanation:
Friedel-Crafts reactions involve electrophilic attack on the benzene ring. Nitrobenzene contains the $-NO_2$ group, which is a very strong electron-withdrawing group (deactivator). This significantly reduces the electron density of the ring, making it unreactive toward the electrophiles generated in Friedel-Crafts conditions.

Q55.

Answer: A

Explanation:

Acid-catalyzed hydration follows Markovnikov's rule but is subject to carbocation rearrangements. The initial secondary carbocation formed from 3,3-dimethyl-1-butene undergoes a 1,2-methyl shift to form a more stable tertiary carbocation, which then reacts with water to produce the major alcohol product.

Q56.

Answer: C

Explanation:
The reaction pathway is determined by the reagents used. A Lewis acid ($FeCl_3$) promotes electrophilic substitution on the aromatic ring. In contrast, ultraviolet light promotes a free-radical substitution specifically on the aliphatic side chain (the methyl group).

Q57.

Answer: D

Explanation:
This is the standard Friedel-Crafts alkylation reaction. The methyl chloride reacts with the aluminum chloride catalyst to generate a methyl electrophile, which then substitutes a hydrogen atom on the benzene ring.

Q58.

Answer: D

Explanation:

The addition of HBr to 3-methyl-1-butene involves the formation of a secondary carbocation. This carbocation is adjacent to a tertiary carbon, allowing for a 1,2-hydride shift to form a significantly more stable tertiary carbocation. The bromide ion then attacks this more stable intermediate.

Q59.

Answer: D

Explanation:
In the presence of organic peroxides, the addition of HBr to an unsymmetrical alkene like propene follows the anti-Markovnikov rule, also known as the Kharasch effect. This occurs via a free-radical mechanism where the bromine atom ends up attached to the less substituted carbon atom of the double bond, resulting in the formation of n-propyl bromide (1-bromopropane).

Q60.

Answer: B

Explanation:
The dehydration of alcohols over an alumina (Al_2O_3) catalyst to produce alkenes is primarily governed by temperature. Different temperatures can lead to different products; for instance, lower temperatures might favor ether formation, while higher temperatures (typically around $620\ \mathrm{K}$) facilitate the elimination of water to form alkenes (olefins).

Q61.

Answer: A

Explanation:
When 2-bromopentane undergoes dehydrohalogenation with a strong base like potassium ethoxide, it follows Saytzeff's rule, which states that the more substituted alkene will be the major product. Between the possible internal alkene isomers, trans-2-pentene is more stable than cis-2-pentene due to reduced steric hindrance between the alkyl groups, making it the predominant product.

Q62.

Answer: D

Explanation:
The addition of HBr to an alkene like propene in the absence of peroxides proceeds via an electrophilic addition mechanism. The reaction is initiated by the attack of an electrophile (H^+) on the electron-rich double bond, forming a carbocation intermediate, which is then attacked by the nucleophilic bromide ion (Br^-).

Q63.

Answer: C

Explanation:
The anti-Markovnikov addition (peroxide effect) is only relevant for unsymmetrical alkenes. In a symmetrical alkene like but-2-ene, both carbon atoms involved in the double bond are identical and have the same number of hydrogen atoms; therefore, adding the bromine to either carbon results in the same product, making the "anti-Markovnikov" distinction meaningless.

Q64.

Answer: C

Explanation:
The conversion of a geminal dihalide ($R-CH_2-CCl_2-R$) into an alkyne ($R-C\equiv C-R$) requires a double dehydrohalogenation reaction. This is typically achieved using a strong base like alcoholic KOH (potassium hydroxide in ethanol), which facilitates the elimination of two molecules ofHCl.

Q65.

Answer: D

Explanation:

The reaction of an alkene with chlorine under UV light ($h\nu$) proceeds via a free-radical mechanism favoring substitution at the allylic position. In contrast, reacting with chlorine in a non-polar solvent like CCl_4 follows an electrophilic addition mechanism across the double bond.

Q66.

Answer: D

Explanation:
This reaction sequence involves an elimination reaction to form an alkene, followed by Markovnikov addition of a hydrohalic acid, and finally a nucleophilic substitution to produce an alcohol.

Q67.

Answer: D

Explanation:

The reaction of 1-methylcyclopentene with $\mathrm{D\text{-}Cl}$ is an electrophilic addition reaction that follows Markovnikov's rule. The electrophile (D^+) adds to the carbon of the double bond with more hydrogens (the CHcarbon), forming a more stable tertiary carbocation at the methyl-substituted carbon. The nucleophilic chloride ion (Cl^-) then attacks the planar carbocation from either side, resulting in a mixture of stereoisomers (enantiomers and potentially diastereomers depending on the addition geometry).

Q68.

Answer: D

Explanation:

This reaction involves the formation of a carbocation followed by a ring expansion. A four-membered ring expands to a five-membered ring to relieve angle strain, creating a more stable molecular framework before the nucleophile attacks.

Q69.

Answer: C

Explanation:
The number of isomeric alkenes formed during dehydrohalogenation depends on the number of non-equivalent β-hydrogens available for removal and the possibility of geometric (cis/trans) isomerism in the resulting products. 2-Bromopentane has two non-equivalent sets of β-hydrogens, leading to multiple structural isomers, one of which further exhibits geometric isomerism, yielding the highest total count.

Q70.

Answer: B

Q71.

Answer: D

Explanation:

The sequence involves electrophilic aromatic substitution, benzylic radical halogenation, and finally an elimination reaction to form a substituted alkene.

Q72.

Answer: B

Explanation:
To achieve the correct substitution pattern, benzene must first be converted to ethylbenzene. Bromination of ethylbenzene is para-directing, and subsequent nitration is directed to the ortho position relative to the ethyl group due to its activating nature.

Q73.

Answer: C

Q74.

Answer: D

Explanation:

In the presence of peroxides, the addition of HBr to an alkene follows an anti-Markovnikov pathway. The subsequent reaction with CoF_2 is a Swarts reaction, which exchanges the bromine atom for a fluorine atom.

Q75.

Answer: D

Explanation:

A racemic product is formed when a reaction creates a chiral center in a 50:50 ratio of enantiomers. In option D, the reaction involves a carbocation rearrangement that leads to a product with no chiral center, making it optically inactive rather than racemic.

Q76.

Answer: D

Explanation:

The addition of two equivalents ofHBrto the diene is governed by the electronic effects of the methyl (activating) and nitro (strongly deactivating) groups. The final regio chemistry is determined by the stability of the successive carbocation intermediates.

Q77.

Answer: D

Q78.

Answer: B

Explanation:

The reaction of an alkene with chlorine in water produces a halohydrin. The reaction proceeds through a cyclic chloronium ion intermediate, which is then attacked by water at the more substituted carbon atom.

Q79.

Answer: D

Explanation:
In the presence of a strong electron-withdrawing group like CF_3, the stability of a carbocation at the adjacent carbon is greatly reduced due to the $-I$ effect. This destabilization forces the reaction to proceed through a different pathway, resulting in an "anti-Markovnikov" regiochemical outcome.

Q80.

Answer: D

Explanation:

The reaction involves a tertiary alkyl halide and a bulky base (potassium t-butoxide). Because the substrate is sterically hindered and the base is also extremely bulky, nucleophilic substitution (S_N2) is impossible. Instead, E2 elimination occurs exclusively.

Q81.

Answer: D

Explanation:

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

Q82.

Answer: B

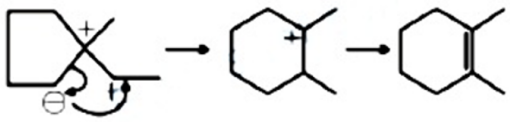
Explanation:

The reaction takes place in the presence of sodium methoxide $(\mathrm{CH_3O^-})$ in methanol. The substrate undergoes dehydrohalogenation (E2 elimination). Removal of a β-hydrogen and simultaneous elimination of bromide lead to the formation of the more substituted alkene. According to Saytzeff's rule, the more substituted alkene is the major product. Hence, Option B is the correct answer.

Q83.

Answer: B

Explanation:



Q84.

Answer: A

Explanation:

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

Q85.

Answer: B

Explanation:

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

Q86.

Answer: A

Explanation:

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

Q87.

Answer: B

Explanation:

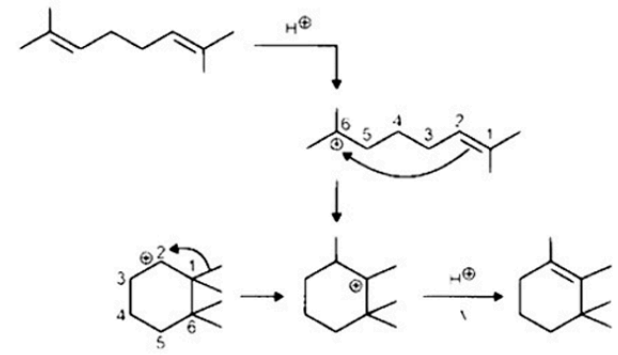
The reaction involves the addition of HBrto 3-methylhex-2-ene in the presence of peroxide. This results in the formation of 2-bromo-3-methylhexane. The solution indicates that the product contains 2 chiral centers, and therefore the total number of stereoisomers is 4.

Q88.

Answer: A

Explanation:

The uploaded image contains only the question and reaction. The options (A–D) and the explanation page are missing, so I cannot reproduce the explanation from the source document or identify the correct option.



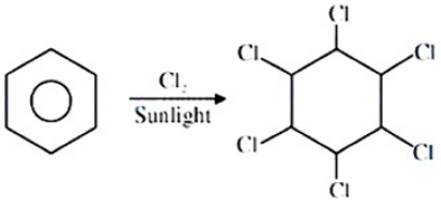
Number of sp^2 hybridised carbon atoms = 2

Q89.

Answer: D

Explanation:

Benzene undergoes an addition reaction with chlorine under the influence of ultraviolet light (sunlight) to form Benzene Hexachloride (BHC), also known as Gammexane or Lindane. The formula for the product is $C_6H_6Cl_6$.



Q90.

Answer: B

Explanation:

The sequence involves anti-Markovnikov addition of HBr followed by a Swarts reaction to substitute the bromine with fluorine. The source indicates that the total number of products/stereoisomers possible for this sequence is 2.

Q91.

Answer: B

Q92.

Answer: C

Q93.

Answer: A

Q94.

Answer: B

Q95.

Answer: C

Q96.

Answer: A

Q97.

Answer: B

Q98.

Answer: C

Q99.

Answer: A

Q100.

Answer: C

Q101.

Answer: B

Q102.

Answer: C

Q103.

Answer: B

Q104.

Answer: C

Q105.

Answer: A

Q106.

Answer: B

Q107.

Answer: C

Q108.

Answer: C

Q109.

Answer: B

Q110.

Answer: B

Q111.

Answer: C

Q112.

Answer: A

Q113.
Answer: C

Q114.
Answer: D

Q115.
Answer: D

Q116.
Answer: A

Q117.
Answer: A

Q118.
Answer: D

Q119.
Answer: B

Q120.
Answer: C

Q121.
Answer: A

Q122.
Answer: C

Q123.
Answer: D

Q124.
Answer: A

Q125.
Answer: D

Q126.
Answer: A

Q127.
Answer: D

Q128.
Answer: B

Q129.
Answer: B

Q130.
Answer: B

Q131.
Answer: B

Q132.
Answer: C

Q133.
Answer: B

Q134.
Answer: D

Q135.
Answer: A

Q136.
Answer: A

Q137.
Answer: A

Q138.
Answer: C

Q139.
Answer: C

Q140.
Answer: D

Q141.
Answer: B

Q142.
Answer: D

Q143.
Answer: B

Q144.
Answer: A

Q145.
Answer: B

Q146.
Answer: A

Q147.
Answer: B

Q148.
Answer: D

Q149.
Answer: A

Q150.
Answer: B

Q151.
Answer: A

Q152.
Answer: D

Q153.
Answer: A

Q154.
Answer: A

Q155.
Answer: C

Q156.
Answer: D

Q157.
Answer: C

Q158.
Answer: C

Q159.
Answer: D

Q160.
Answer: D

Q161.
Answer: D

Q162.
Answer: D

Q163.
Answer: A

Q164.
Answer: A

Q165.
Answer: A

Q166.
Answer: B

Q167.
Answer: B

Q168.
Answer: D

Q169.
Answer: B

Q170.
Answer: B

Q171.
Answer: B

Q172.
Answer: C

Q173.
Answer: B

Q174.
Answer: A

Q175.
Answer: A

Q176.
Answer: B

Q177.
Answer: C

Q178.
Answer: B

Q179.
Answer: A

Q180.
Answer: D