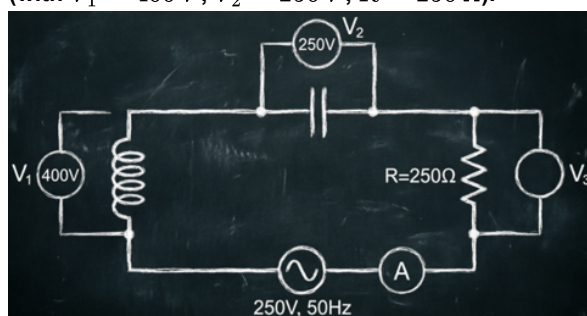


Physics

1. A capacitor, a resistor and an inductor are connected in series to an ac-source of 250 V and frequency 50 Hz. Find reading of voltmeter V_3 and ammeter in the given LCR-series circuit from the image given below (with $V_1 = 400$ V, $V_2 = 250$ V, $R = 250 \Omega$).



- A) $V_3 = 200$ V, $I = 0.8$ A B) $V_3 = 250$ V, $I = 1$ A
 C) $V_3 = 150$ V, $I = 0.6$ A D) $V_3 = 200$ V, $I = 0.4$ A

2. A current of 4 A flows in a coil when connected to a 24 V dc source. If the same coil is connected to a 24 V, 40 rad/s a.c. source, a current of 2.4 A flows in the circuit. Determine the inductance of the coil.

- A) 100 mH B) 200 mH
 C) 300 mH D) 400 mH

3. A coil of reactance 300Ω and resistance 300Ω is connected to a 600 V, 25 Hz a.c. supply. (a) What is the maximum current in the coil? (b) What is the time lag between the voltage maximum and the current maximum?

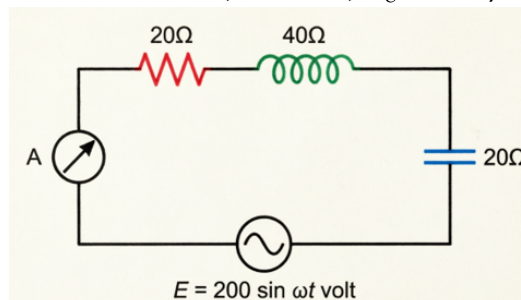
- A) (a) 3 A, (b) 2.5 ms B) (a) 2 A, (b) 5 ms
 C) (a) 2 A, (b) 10 ms D) (a) 1 A, (b) 5 ms

4. Match the following circuit components connected across an a.c. source of angular frequency $\omega = 1000$ rad/s with the phase difference between current and source voltage.

Column I	Column II
(A) Series combination of $10\sqrt{3} \Omega$ and $100 \mu F$	(p) $\frac{\pi}{2}$
(B) Pure inductor of 0.02 H	(q) $\frac{\pi}{6}$
(C) Pure capacitor of $200 \mu F$	(r) $\frac{\pi}{4}$
(D) Series combination of 10Ω and $\frac{\sqrt{3}}{100} H$	(s) $\frac{\pi}{3}$
(E) Series combination of 0.02 H and $50 \mu F$	(t) 0

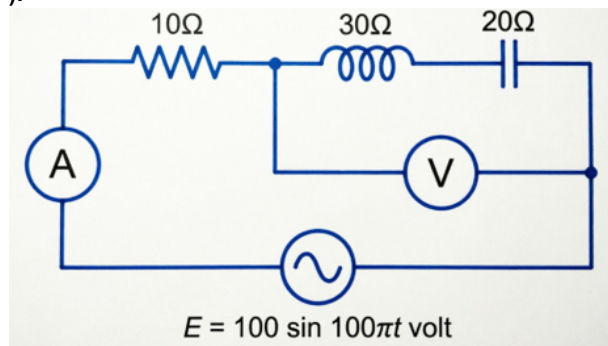
- A) A-p, B-q, C-p, D-s, E-t B) A-q, B-r, C-p, D-s, E-t
 C) A-q, B-p, C-p, D-s, E-t D) A-q, B-p, C-s, D-p, E-t

5. Find out reading of A.C. ammeter and also calculate the potential difference across resistance and capacitor from the image given below (with $E = 200 \sin \omega t$ volt, $R = 20 \Omega$, $X_C = 20 \Omega$).



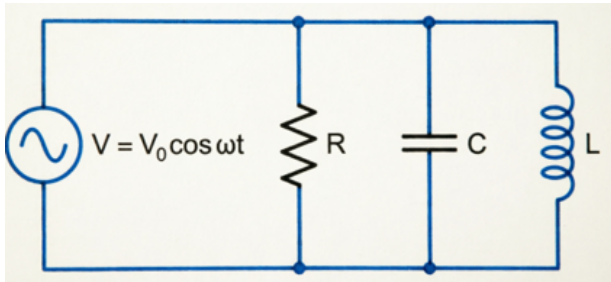
- A) Ammeter = 10 A, $V_R = V_C = 200$ V B) Ammeter = 5 A, $V_R = V_C = 50$ V
 C) Ammeter = 5 A, $V_R = V_C = 100$ V D) Ammeter = 7.07 A, $V_R = V_C = 141.4$ V

6. In given circuit find the reading of ammeter and voltmeter from the image given below (with $E = 100 \sin 100\pi t$ volt, and resistors 10Ω , 30Ω , 20Ω).



- A) Ammeter = 2.5 A, Voltmeter = 25 V B) Ammeter = 10 A, Voltmeter = 100 V
 C) Ammeter = 5 A, Voltmeter = 50 V D) Ammeter = 7.07 A, Voltmeter = 70.7 V

7. For the circuit shown in figure, write down the instantaneous current through each element from the image given below (with $V = V_0 \cos \omega t$ applied across parallel R, L, C).



A) $i_R = \frac{V_0}{R} \cos \omega t$,
 $i_L = -\frac{V_0}{\omega L} \sin \omega t$,
 $i_C = V_0 \omega C \sin \omega t$
C) $i_R = \frac{V_0}{R} \sin \omega t$,
 $i_L = \frac{V_0}{\omega L} \cos \omega t$,
 $i_C = V_0 \omega C \cos \omega t$

B) $i_R = \frac{V_0}{R} \cos \omega t$,
 $i_L = \frac{V_0}{\omega L} \sin \omega t$,
 $i_C = -V_0 \omega C \sin \omega t$
D) $i_R = \frac{V_0}{R} \cos \omega t$,
 $i_L = -\frac{V_0}{\omega L} \cos \omega t$,
 $i_C = V_0 \omega C \sin \omega t$

8. A variable frequency alternating voltage source with voltage amplitude 250 V is connected across a series combination of $L = 4.0$ H, $C = 25 \mu F$ and $R = 50 \Omega$. Calculate (a) The angular frequency of the source at resonance. (b) Amplitude of current at resonance frequency.

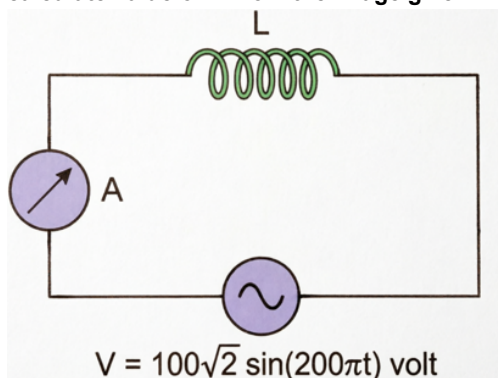
- A)** (a) 50 rad/s, (b) 3.5 A **B)** (a) 100 rad/s, (b) 5 A
C) (a) 100 rad/s, (b) 7 A **D)** (a) 200 rad/s, (b) 5 A

9. A series LCR circuit with $L = 0.1$ H, $C = 100$ nF, $R = 40 \Omega$ is connected to a 200 V variable frequency supply. Find – (a) Source frequency for which current is maximum. (b) Q-factor of the given circuit.

- A)** (a) 3.18×10^3 Hz, (b) Q = 12.5 **B)** (a) 1.59×10^3 Hz, (b) Q = 25
C) (a) 1.59×10^3 Hz, (b) Q = 50 **D)** (a) 6.37×10^2 Hz, (b) Q = 25

10. In given circuit applied voltage

$V = 100\sqrt{2} \sin(200\pi t)$ volt and ammeter reading is 4 A then calculate value of L from the image given



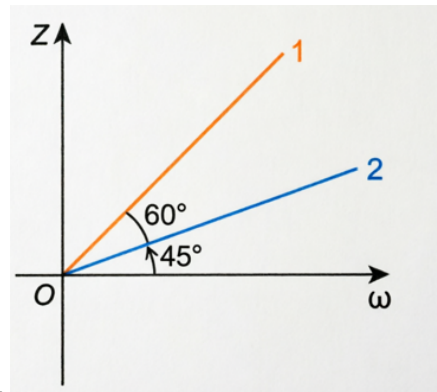
below.

- A)** $\frac{1}{2\pi}$ H **B)** $\frac{1}{4\pi}$ H
C) $\frac{1}{8\pi}$ H **D)** $\frac{1}{6\pi}$ H

11. An inductor of $\frac{20}{\pi}$ mH is connected across an ac-source of 100 V, 50 Hz. Find out impedance, root mean square current, peak current, and the equation of current.

- A)** $Z = 1 \Omega$, $I_{rms} = 100$ A, **B)** $Z = 2 \Omega$, $I_{rms} = 25$ A,
 $I_0 = 100\sqrt{2}$ A, $I_0 = 25\sqrt{2}$ A,
 $I = 100\sqrt{2} \sin(100\pi t - \frac{\pi}{2})$ $I = 25\sqrt{2} \sin(100\pi t + \frac{\pi}{2})$
C) $Z = 4 \Omega$, $I_{rms} = 25$ A, **D)** $Z = 2 \Omega$, $I_{rms} = 50$ A,
 $I_0 = 25\sqrt{2}$ A, $I_0 = 50\sqrt{2}$ A,
 $I = 25\sqrt{2} \sin(100\pi t - \frac{\pi}{2})$ $I = 50\sqrt{2} \sin(100\pi t - \frac{\pi}{2})$

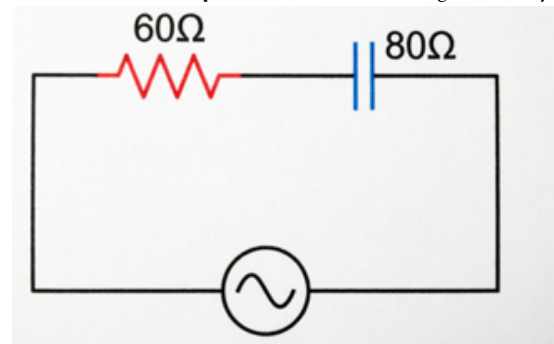
12. Across two different inductors same alternating source is connected. For this Z versus ω graph is given. Find out the ratio $\frac{L_1}{L_2}$ from the image given below (line 1 makes 60° and line 2 makes 45° with the



ω -axis).

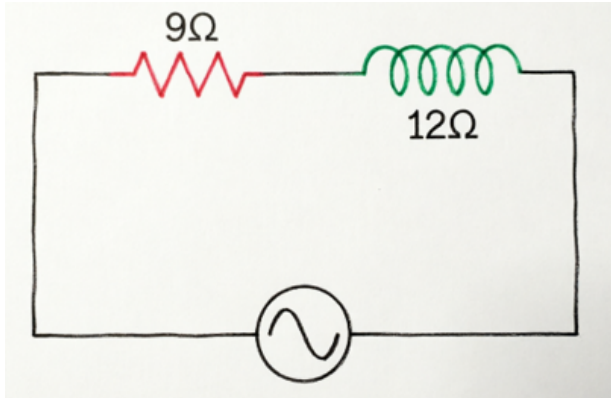
- A)** 3 **B)** $\sqrt{3}$
C) $\frac{1}{\sqrt{3}}$ **D)** $\frac{1}{3}$

13. Calculate the impedance of the circuit shown from the image given below (a series RC circuit with resistance $R = 60 \Omega$ and capacitive reactance $X_C = 80 \Omega$).



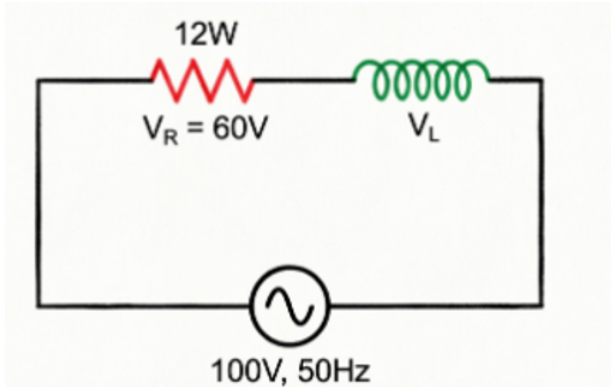
- A)** 140Ω **B)** 100Ω
C) 60Ω **D)** 80Ω

14. Calculate the impedance of the circuit shown from the image given below (a series RL circuit with resistance $R = 9\Omega$ and inductive reactance $X_L = 12\Omega$).



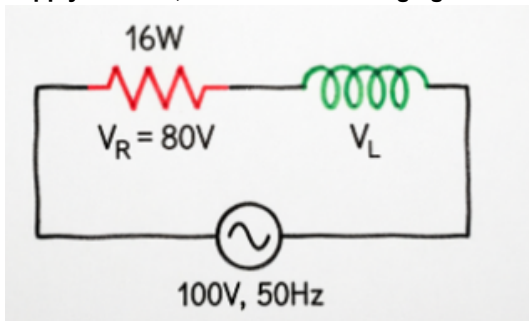
- A) 21Ω B) 3Ω
C) 12Ω D) 15Ω

15. Find out the required inductance to put in series of bulb (12 W, 60 V) to run it safely across an alternating supply of 100 V, 50 Hz from the image given below.



- A) $\frac{2}{\pi}$ H B) $\frac{4}{\pi}$ H
C) $\frac{3}{\pi}$ H D) $\frac{5}{\pi}$ H

16. Find out the required inductance to put in series of bulb (16 W, 80 V) to run it safely across an alternating supply of 100 V, 50 Hz from the image given below.



- A) $\frac{2}{\pi}$ H B) $\frac{3}{\pi}$ H
C) $\frac{4}{\pi}$ H D) $\frac{5}{\pi}$ H

17. An alternating current source $E = 100 \sin(500t)$ volt is connected through an inductor of 20 mH then write down the equation of current.

- A) $20 \sin(500t - \frac{\pi}{2})$ A B) $10 \sin(500t + \frac{\pi}{2})$ A
C) $10 \sin(500t - \frac{\pi}{2})$ A D) $10 \cos(500t)$ A

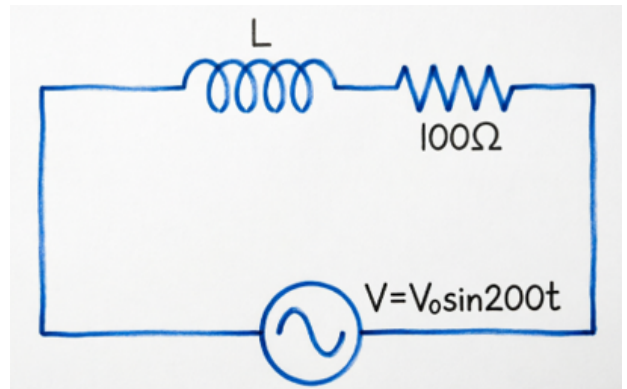
18. An alternating current source $E = 250 \sin(2500t)$ volt is connected through an inductor of 20 mH then write down the equation of current.

- A) $50 \sin(2500t - \frac{\pi}{2})$ A B) $5 \sin(2500t + \frac{\pi}{2})$ A
C) $25 \sin(2500t - \frac{\pi}{2})$ A D) $5 \sin(2500t - \frac{\pi}{2})$ A

19. When a series combination of inductance and resistance are connected with a 25 V, 50 Hz a.c. source, a current of 5 A flows in the circuit. The voltage leads the current by a phase angle of 53 degree (given $\cos 53^\circ = 0.6$, $\sin 53^\circ = 0.8$). Calculate the values of resistance and inductive reactance.

- A) $R = 4\Omega$, $X_L = 3\Omega$ B) $R = 3\Omega$, $X_L = 5\Omega$
C) $R = 3\Omega$, $X_L = 4\Omega$ D) $R = 5\Omega$, $X_L = 3\Omega$

20. From the image given below, the current in the shown circuit is found to be $i = 3 \sin(200t - \frac{\pi}{4})$ A. Find the value of inductance.



- A) 0.25 H B) 1.0 H
C) 0.5 H D) 2.0 H

21. A $\frac{50}{\pi} \mu F$ capacitor and 150-ohm resistance are joined in series to an ac source of 200 volt and 50 Hz frequency. The power factor of the circuit and the power dissipated in it

- A) 0.8, 48 W B) 0.6, 48 W
C) 0.6, 96 W D) 0.8, 96 W

22. Find out instantaneous voltage for $V = 200 \sin(600\pi t)$ at $t = \frac{1}{3600}$ sec

- A) 100 V B) 200 V
C) $100\sqrt{2}$ V D) $100\sqrt{3}$ V

23. Find out instantaneous voltage for $V = 400 \sin(800\pi t)$ at $t = \frac{1}{3200}$ sec

- A) 200 V B) 400 V
C) $200\sqrt{2}$ V D) $100\sqrt{2}$ V

24. Find out RMS value of following currents (i) $I = a \cos(\omega t) + b \sin(\omega t)$ (ii) $I = a + b \cos(\omega t)$

- A) (i) $\sqrt{\frac{a^2}{2} + \frac{b^2}{2}}$, (ii) $\sqrt{\frac{a^2}{2} + \frac{b^2}{2}}$ B) (i) $\sqrt{\frac{a^2}{2} + \frac{b^2}{2}}$, (ii) $\sqrt{a^2 + \frac{b^2}{2}}$
C) (i) $\sqrt{a^2 + b^2}$, (ii) $\sqrt{\frac{a^2}{2} + b^2}$ D) (i) $\sqrt{\frac{a^2}{2} + b^2}$, (ii) $\sqrt{a^2 + b^2}$

25. The current and voltage in a circuit are given by
 $i = 2.5 \sin(314t + 45^\circ)$ A and $V = 20 \sin(314t - 45^\circ)$ volt. Find (a) time period of current (b) phase difference between voltage and current.

- A) $T = 0.01$ s, $\Delta\phi = 90^\circ$ B) $T = 0.02$ s, $\Delta\phi = 45^\circ$
 C) $T = 0.02$ s, $\Delta\phi = 90^\circ$ D) $T = 0.04$ s, $\Delta\phi = 90^\circ$

26. If $V_1 = V_0 \sin(\omega t)$ and $V_2 = V_0 \sin(\omega t + \frac{\pi}{2})$, then find the resultant of the two voltages.

- A) $V_0 \sin(\omega t + \frac{\pi}{4})$ B) $\sqrt{2}V_0 \sin(\omega t + \frac{\pi}{4})$
 C) $\sqrt{3}V_0 \sin(\omega t + \frac{\pi}{4})$ D) $2V_0 \sin(\omega t + \frac{\pi}{3})$

27. If $V_1 = V_0 \sin(\omega t)$ and $V_2 = V_0 \sin(\omega t + \frac{\pi}{3})$, find the resultant of the two voltages.

- A) $V_0 \sin(\omega t + \frac{\pi}{6})$ B) $\sqrt{2}V_0 \sin(\omega t + \frac{\pi}{6})$
 C) $\sqrt{3}V_0 \sin(\omega t + \frac{\pi}{6})$ D) $2V_0 \sin(\omega t + \frac{\pi}{3})$

28. If $V_1 = V_0 \sin(\omega t)$ and $V_2 = V_0 \sin(\omega t + \frac{\pi}{2})$, then find the resultant of the two voltages.

- A) $V_0 \sin(\omega t + \frac{\pi}{4})$ B) $\sqrt{2}V_0 \sin(\omega t + \frac{\pi}{4})$
 C) $\sqrt{3}V_0 \sin(\omega t + \frac{\pi}{4})$ D) $2V_0 \sin(\omega t + \frac{\pi}{4})$

29. If $V_1 = V_0 \sin(\omega t)$ and $V_2 = V_0 \sin(\omega t + \frac{2\pi}{3})$, then find the resultant of the two voltages.

- A) $V_0 \sin(\omega t + \frac{\pi}{3})$ B) $\sqrt{2}V_0 \sin(\omega t + \frac{\pi}{3})$
 C) $\sqrt{3}V_0 \sin(\omega t + \frac{\pi}{3})$ D) $2V_0 \sin(\omega t + \frac{\pi}{6})$

30. A voltage $V = 100 \sin(\pi t)$ volt is applied across a 50Ω resistor. What will an ac ammeter in series with the resistor read?

- A) 2 A B) 2.83 A
 C) 1.41 A D) 4 A

31. An alternating current source $E = 200 \sin(500t)$ volt is connected through an inductor of 40 mH, then write down the equation of current.

- A) $10 \sin(500t + \frac{\pi}{2})$ A B) $20 \sin(500t - \frac{\pi}{2})$ A
 C) $10 \sin(500t - \frac{\pi}{2})$ A D) $5 \sin(500t - \frac{\pi}{2})$ A

32. An alternating current source $E = 50 \sin(5000t)$ volt is connected through an inductor of $20 \mu H$, then write down the equation of current.

- A) $500 \sin(5000t - \frac{\pi}{2})$ A B) $50 \sin(5000t - \frac{\pi}{2})$ A
 C) $500 \sin(5000t + \frac{\pi}{2})$ A D) $5000 \sin(5000t - \frac{\pi}{2})$ A

33. An alternating voltage $E = 200\sqrt{2} \sin(100t)$ volt is applied to a 1 H inductor through an a.c. ammeter. What will be the reading of the ammeter?

- A) 1.41 A B) 1.0 A
 C) 2.0 A D) 2.83 A

34. What will be the equation of ac of frequency 50 Hz if its r.m.s. value is 10 A

- A) $i = 10 \sin(100\pi t)$ B) $i = 10\sqrt{2} \sin(50\pi t)$
 C) $i = 10\sqrt{2} \sin(100\pi t)$ D) $i = \frac{10}{\sqrt{2}} \sin(100\pi t)$

35. The peak value of an alternating e.m.f. E is given by $E = E_0 \cos \omega t$ is 20 volts and its frequency is 50 Hz. At time $t = \frac{1}{300}$ sec, the instantaneous e.m.f. is

- A) 20 V B) $10\sqrt{3}$ V
 C) 10 V D) 5 V

36. The instantaneous value of current in an ac circuit is $i = 4 \sin(50\pi t + \pi/6)$ A. The current at the beginning ($t = 0$) will be

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

37. The voltage of an ac source varies with time according to the equation $V = 200 \sin(50\pi t) \cos(50\pi t)$ where t is in seconds and V is in volts. Then

- A) The peak voltage of the source is 200 volts B) The frequency of the source is 100 Hz
 C) The peak voltage of the source is 100 volts D) The peak voltage of the source is $100/\sqrt{2}$ volts

38. In an ac circuit, V and i are given by $V = 200 \sin(200t)$ volt, and $i = 200 \sin(200t + \frac{\pi}{3})$ mA. The power dissipated in circuit is

- A) 20 watt B) 10 watt
 C) 5 watt D) 40 watt

39. In a circuit an alternating current and a direct current are supplied together. The expression of the instantaneous current is given as $i = 2 + 4 \sin \omega t$. Then the r.m.s. value of the current is

- A) $2\sqrt{2}$ A B) $2\sqrt{3}$ A
 C) 2 A D) 4 A

40. Voltage and current in an ac circuit are given by $V = 6 \sin(50\pi t + \frac{\pi}{6})$ and $i = 3 \sin(50\pi t + \frac{\pi}{2})$

- A) Voltage leads the current by 60° B) Current leads the voltage by 30°
 C) Current leads the voltage by 60° D) Voltage leads the current by 90°

41. The r.m.s. value of alternating current in a circuit is 2 A and power factor is 0.5. If the power dissipated in the circuit is 100 W, then the peak value of voltage in the circuit is

- A) 100 volt B) 70 volt
 C) 141 volt D) 200 volt

42. An ac voltage source of $E = 200 \sin 100 t$ is used to run a device which offers a resistance of 40Ω and restricts the flow of current in one direction only. The r.m.s. value of current in the circuit will be

- A) 5 A B) 2.5 A
 C) 3.54 A D) 1.25 A

43. In a purely inductive circuit if $L = \frac{50}{\pi} \times 10^{-3}$ H and applied alternating voltage is given by $V = 200 \sin 200 \pi t$, find the frequency and time period respectively

- A) 50 Hz, 0.02 sec B) 200 Hz, 0.005 sec
 C) 100 Hz, 0.01 sec D) 100 Hz, 0.05 sec

44. An alternating voltage $E = 100\sqrt{2} \sin(200t)$ is connected to a 2 microfarad capacitor through an ac ammeter. The reading of the ammeter shall be

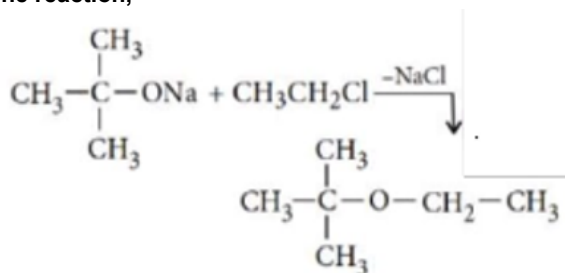
- A) 20 mA B) 80 mA
C) 40 mA D) 10 mA

45. A bulb of 80 volt and 16 watt is connected with 100 volt, 50 Hz of ac source with an inductance coil in series. If bulb illuminates with its full intensity then value of inductance of coil

- A) 1.28 H B) 0.95 H
C) 1.91 H D) 2.55 H

Chemistry

46. The reaction,

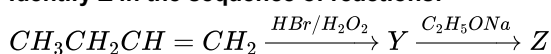


is

called:

- A) Etard reaction B) Gattermann-Koch reaction
C) Williamson synthesis D) Williamson continuous etherification process

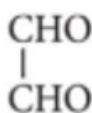
47. Identify Z in the sequence of reactions:



- A) $\text{CH}_3 - (\text{CH}_2)_3 - \text{O} - \text{CH}_2 - \text{CH}(\text{CH}_3)_2 - \text{O} - \text{CH}_2\text{CH}_3$
B) $\text{CH}_3 - (\text{CH}_2)_3 - \text{O} - \text{CH}_2 - \text{CH}(\text{CH}_3)_2 - \text{O} - \text{CH}_2\text{CH}_3$
C) $\text{CH}_3(\text{CH}_2)_4 - \text{O} - \text{CH}_3$ D) $\text{CH}_3\text{CH}_2 - \text{CH}(\text{CH}_3) - \text{O} - \text{CH}_2\text{CH}_3$

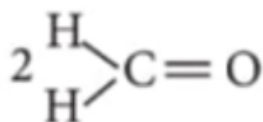
48. $\text{HOCH}_2 - \text{CH}_2\text{OH}$ on heating with periodic acid gives:

- A) 2HCOOH

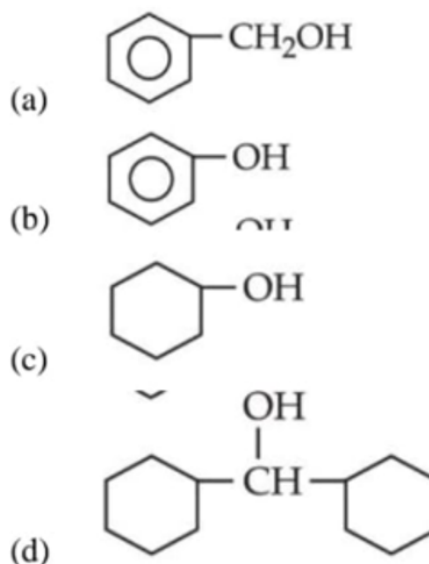


B)

- D) 2CO_2



49. Which of the following compounds has the most acidic nature?



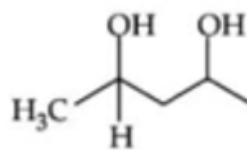
- A) (a) B) (b)
C) (c) D) (d)

50. The compound which does not react with sodium is:

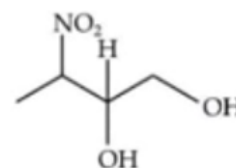
- A) CH_3COOH B) $\text{CH}_3\text{CHOHCH}_3$
C) $\text{C}_2\text{H}_5\text{OH}$ D) CH_3OCH_3

51. Which amongst the following will be most readily dehydrated under acidic conditions?

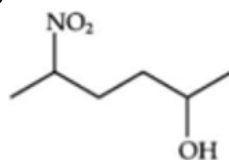
A)



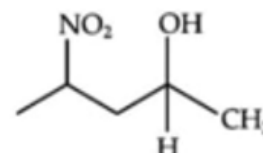
B)



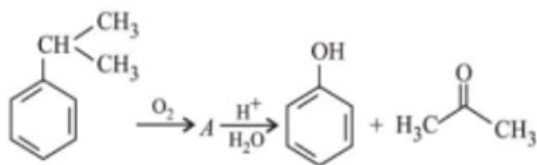
C)



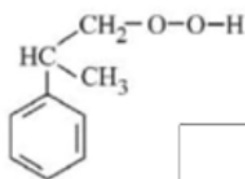
D)



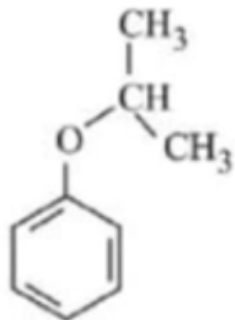
52. The structure of intermediate A in the following reaction sequence is:



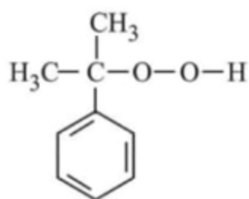
A)



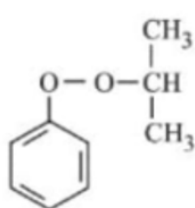
B)



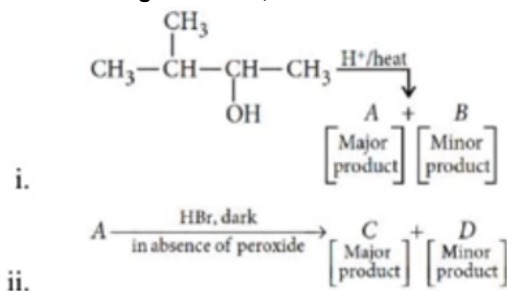
C)



D)

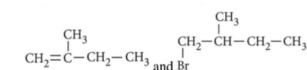


53. In the following reactions,

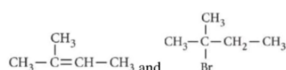


the major products (A) and (C) are respectively:

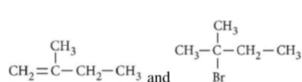
A)



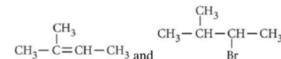
B)



C)

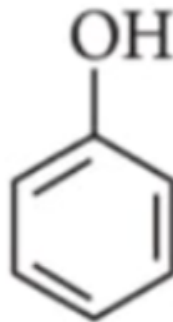


D)



54. Which one is the most acidic compound?

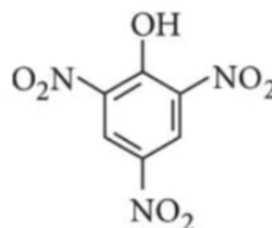
A)



B)



C)



D)



55. Lucas reagent is

A)

conc. HCl and anhydrous $ZnCl_2$

B)

conc. HNO_3 and hydrous $ZnCl_2$

C)

conc. HCl and hydrous $ZnCl_2$

D)

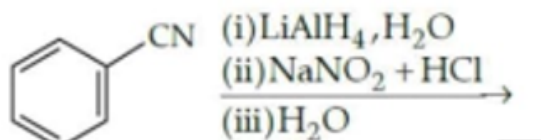
conc. HNO_3 and anhydrous $ZnCl_2$

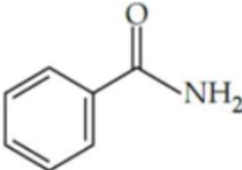
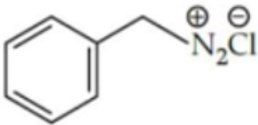
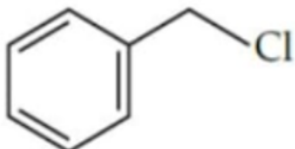
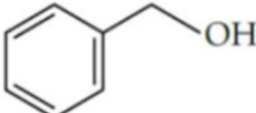
56. Among the following four compounds: (i) Phenol (ii) Methyl phenol (iii) Meta-nitrophenol (iv) Para-nitrophenol The acidity order is:

A) (iv) > (iii) > (i) > (ii) B) (iii) > (iv) > (i) > (ii)

C) (i) > (iv) > (iii) > (ii) D) (ii) > (i) > (iii) > (iv)

57. The product formed from the following reaction sequence is:

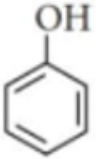
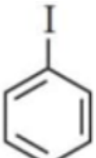
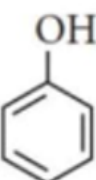
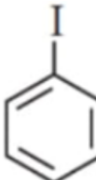


- A) 
- B) 
- C) 
- D) 

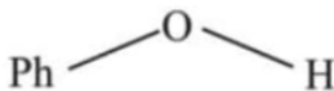
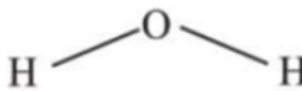
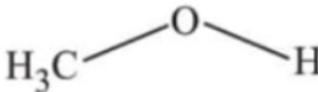
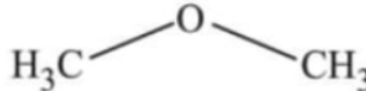
58. Which one of the following will not form a yellow precipitate on heating with an alkaline solution of iodine?

- A) $\text{CH}_3\text{CH}(\text{OH})\text{CH}_3$ B) $\text{CH}_3\text{CH}_2\text{CH}(\text{OH})\text{CH}_3$
 C) CH_3OH D) $\text{CH}_3\text{CH}_2\text{OH}$

59. Anisole on cleavage with HI gives:

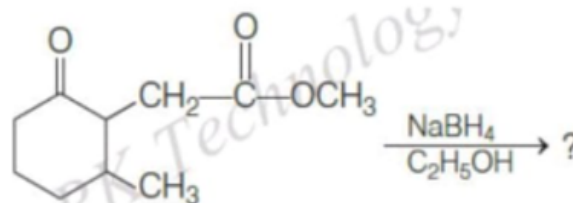
- A)  + CH_3I
- B)  + CH_3OH
- C)  + $\text{C}_2\text{H}_5\text{I}$
- D)  + $\text{C}_2\text{H}_5\text{OH}$

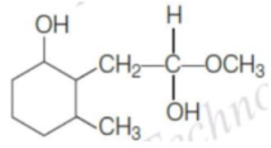
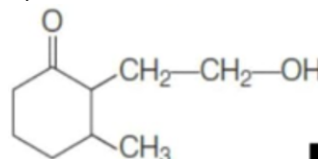
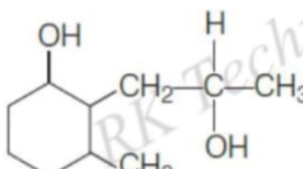
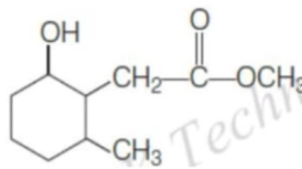
60. The compound that is most difficult to protonate is:

- (a) 
- (b) 
- (c) 
- (d) 

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

61. The product formed in the following chemical reaction is:

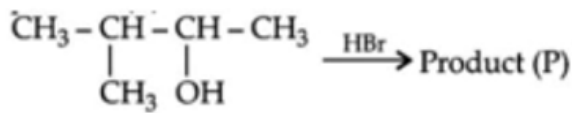


- A) 
- B) 
- C) 
- D) 

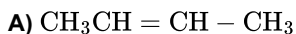
62. Given below are two statements: Statement I: In Lucas test, primary, secondary and tertiary alcohols are distinguished on the basis of their reactivity with conc. $\text{HCl} + \text{ZnCl}_2$, known as Lucas Reagent. Statement II: Primary alcohols are most reactive and immediately produce turbidity at room temperature on reaction with Lucas Reagent. In the light of the above statements, choose the most appropriate answer from the options given below:

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

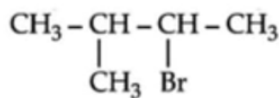
63. Consider the following reaction and identify the product (P):



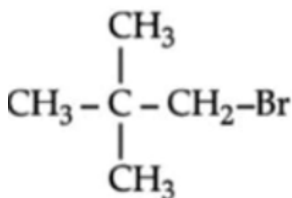
(3-Methylbutan-2-ol)



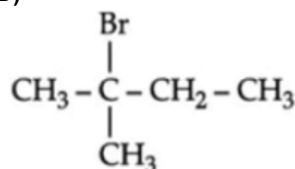
B)



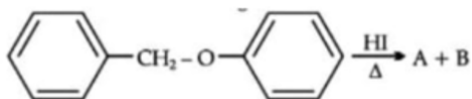
C)



D)

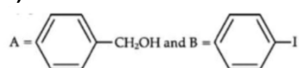


64. Consider the following reaction:



Identify products A and B.

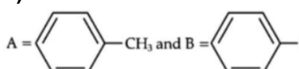
A)



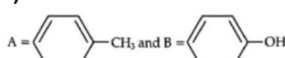
B)



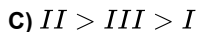
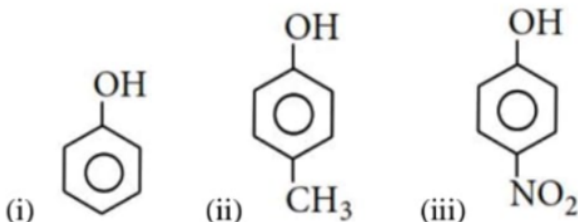
C)



D)

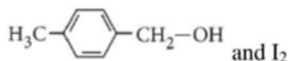


65. The correct acidic order of the following is:

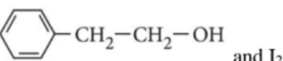


66. Compound A, $\text{C}_8\text{H}_{10}\text{O}$, is found to react with NaOI (produced by reacting Y with NaOH) and yields a yellow precipitate with characteristic smell. A and Y are respectively:

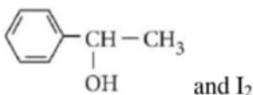
A)



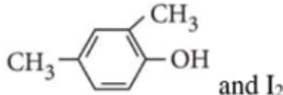
B)



C)

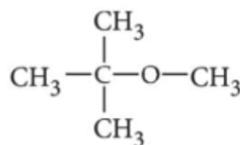


D)

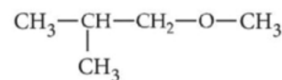


67. Among the following ethers, which one will produce methyl alcohol on treatment with hot concentrated HI?

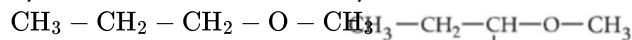
A)



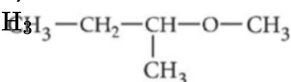
B)



C)

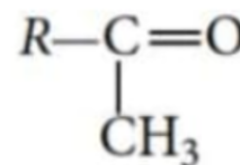


D)

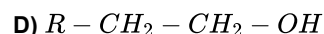
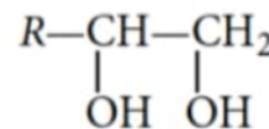


68. The alkene $\text{R} - \text{CH} = \text{CH}_2$ reacts readily with B_2H_6 and the product on oxidation with alkaline hydrogen peroxide produces:

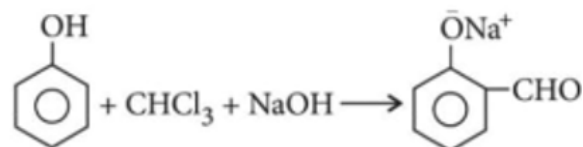
A)



B)



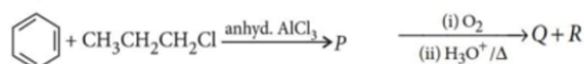
69. In the reaction,



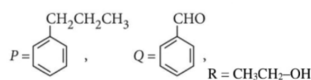
the electrophile involved is:



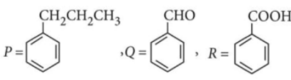
70. Identify the major products P, Q and R in the following sequence of reactions:



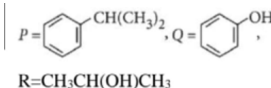
A)



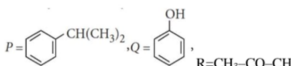
B)



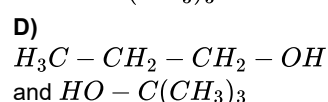
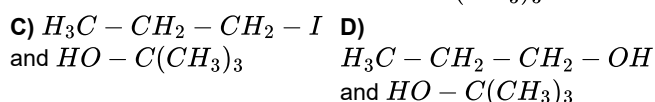
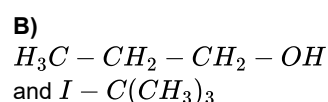
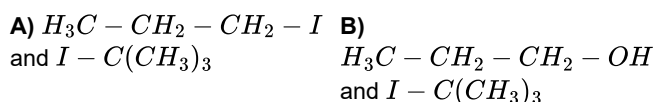
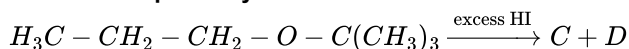
C)



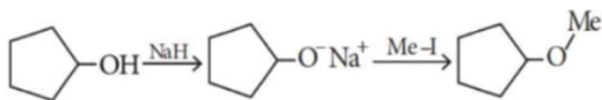
D)



71. The major products C and D formed in the following reactions respectively are:



72. The reaction



can be classified as:

- A) dehydration reaction
B) Williamson alcohol synthesis reaction
C) Williamson ether synthesis reaction
D) alcohol formation reaction

73. Propene, $\text{CH}_3\text{CH}=\text{CH}_2$ can be converted into 1-propanol by oxidation. Indicate which set of reagents amongst the following is ideal for the above conversion?

- A) KMnO_4 (alkaline)
B) Osmium tetroxide ($\text{OsO}_4/\text{CH}_2\text{Cl}_2$)
C) B_2H_6 and alk. H_2O_2
D) O_3/Zn

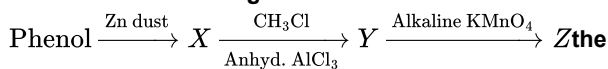
74. The general molecular formula, which represents the homologous series of alkanols is:

- A) $\text{C}_n\text{H}_{2n+2}\text{O}$
B) $\text{C}_n\text{H}_{2n}\text{O}_2$
C) $\text{C}_n\text{H}_{2n}\text{O}$
D) $\text{C}_n\text{H}_{2n+1}\text{O}$

75. Among the following sets of reactants which one produces anisole?

- A) CH_3CHO ; RMgX
B) $\text{C}_6\text{H}_5\text{OH}$; NaOH ; CH_3I
C) $\text{C}_6\text{H}_5\text{OH}$; neutral FeCl_3
D) $\text{C}_6\text{H}_5\text{CH}_3$; CH_3COCl ; AlCl_3

76. Consider the following reaction:



the product Z is:

- A) benzaldehyde
B) benzoic acid
C) benzene
D) toluene

77. Ethylene oxide when treated with Grignard reagent yields:

- A) primary alcohol
B) secondary alcohol
C) tertiary alcohol
D) cyclopropyl alcohol

78. Given are cyclohexanol (I), acetic acid (II), 2,4,6-trinitrophenol (III) and phenol (IV). In these the order of decreasing acidic character will be:

- A) $\text{III} > \text{II} > \text{IV} > \text{I}$
B) $\text{II} > \text{III} > \text{I} > \text{IV}$
C) $\text{II} > \text{III} > \text{IV} > \text{I}$
D) $\text{III} > \text{IV} > \text{II} > \text{I}$

79. Methanol is industrially prepared by

- A) oxidation of CH_4 by steam at 900°C
B) reduction of HCHO using LiAlH_4
C) reaction of HCHO with a solution of NaOH
D) reduction of CO using H_2 and $\text{ZnO} - \text{Cr}_2\text{O}_3$

80. Ethyl chloride is converted into diethyl ether by

- A) Perkins reaction
B) Grignard reaction
C) Wurtz synthesis
D) Williamson's synthesis

81. Which one of the following compounds is resistant to nucleophilic attack by hydroxyl ions?

- A) Diethyl ether
B) Acetonitrile
C) Acetamide
D) Methyl acetate

82. When vapours of a secondary alcohol is passed over heated copper at 573 K, the product formed is

- A) a carboxylic acid
B) an aldehyde
C) a ketone
D) an alkene

83. Ethanol and dimethyl ether form a pair of functional isomers. The boiling point of ethanol is higher than that of dimethyl ether, due to the presence of:

- A) H-bonding in ethanol
B) H-bonding in dimethyl ether
C) CH_3 group in ethanol
D) CH_3 group in dimethyl ether

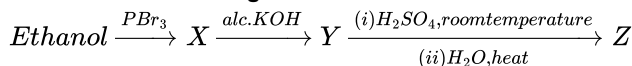
84. Increasing order of acid strength among p-methoxyphenol, p-methylphenol and p-nitrophenol is:

- A) p-nitrophenol, p-methoxyphenol, p-methylphenol
B) p-methylphenol, p-nitrophenol, p-methoxyphenol
C) p-methoxyphenol, p-methylphenol, p-nitrophenol
D) p-methylphenol, p-methoxyphenol, p-nitrophenol

85. When glycerol is treated with excess of HI, it produces:

- A) 2-iodopropane
B) allyl iodide
C) propene
D) glycerol triiodide

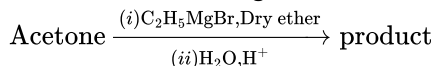
86. Consider the following reaction:



The product Z is:

- A) $\text{CH}_3\text{CH}_2 - \text{O} - \text{CH}_2 - \text{CH}_3$
B) $\text{CH}_3\text{CH}_2 - \text{CH}_2 - \text{O} - \text{SO}_3\text{H}$
C) $\text{CH}_3\text{CH}_2\text{OH}$
D) $\text{CH}_2 = \text{CH}_2$

87. What is the IUPAC name of the organic compound formed in the following chemical reaction?



- A) 2-methyl propan-2-ol
B) pentan-2-ol
C) pentan-3-ol
D) 2-methyl butan-2-ol

88. n-Propyl alcohol and isopropyl alcohol can be chemically distinguished by which reagent?

- A) PCl_5
B) Reduction
C) Oxidation with potassium dichromate
D) Ozonolysis

89. What is formed when a primary alcohol undergoes catalytic dehydrogenation?

- A) Aldehyde
B) Ketone
C) Alkene
D) Acid

90. How many isomers of $\text{C}_5\text{H}_{11}\text{OH}$ will be primary alcohols?

- A) 5
B) 4
C) 2
D) 3

Botany.

91. Downstream processing is a critical phase in commercial product formulation. Which of the following operations is NOT considered an explicit step within downstream processing?

- | | |
|---|---|
| A) Continuous preservation and cell disruption via homogenization. | B) Product separation through centrifugation or filtration. |
| C) Microbial expression profiling and transformation of the host cell inside a bioreactor. | D) Purification using analytical chromatography and formulation with approved preservatives. |

92. In the chemical method of transformation, treating host bacterial cells with a specific divalent cation like calcium (Ca²⁺) increases transformation efficiency by:

- | | |
|--|--|
| A) Directly damaging and lysing the cell wall to let massive DNA plasmids enter freely. | B) Enhancing the efficiency with which DNA enters the bacterium through transient cell wall pores by neutralizing negative charges on both DNA and cell membrane phospholipids. |
| C) Activating the cell's native DNA polymerase to synthesize plasmid copies rapidly. | D) Suppressing the expression of endogenous restriction enzymes that target foreign vectors. |

93. Blue-white screening is preferred over antibiotic selection replica-plating methods because:

- | | |
|---|---|
| A) It eliminates the need to expose bacteria to any hazardous chemicals or toxic dyes. | B) It allows simultaneous identification of recombinants and non-recombinants in a single plating step without multiple replica transfers. |
| C) It relies on active resistance to heavy metals rather than fragile antibiotics. | D) Recombinant colonies retain bright blue colors while non-recombinants turn translucent. |

94. Assertion (A): Agarose gel electrophoresis separates DNA fragments solely on the basis of their net negative charge. Reason (R): The smaller the fragment size in agarose gel electrophoresis, the farther it moves through the sieving matrix matrix. Choose the correct option:

- | | |
|--|--|
| 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. |

95. During a Polymerase Chain Reaction (PCR) cycle, a student accidentally sets the denaturation temperature to 60°C instead of 94°C while keeping other parameters optimal. What will be the immediate outcome of this multi-cycle run?

- | | |
|--|---|
| A) DNA polymerase will be permanently denatured, halting synthesis. | B) Primers will fail to anneal to the template strand. |
| C) The double-stranded DNA template will not separate, yielding zero amplification product. | D) Non-specific binding of primers will generate multiple false bands. |

96. Read the statements carefully: Statement I: DNA is a hydrophobic molecule, hence it cannot pass through cell membranes easily. Statement II: The micro-injection method is highly suitable for transforming plant cells because of their rigid cellulosic cell walls. Which option evaluates these statements correctly?

- | | |
|---|---|
| A) Both statements are true. | B) Both statements are false. |
| C) Statement I is true, Statement II is false. | D) Statement I is false, Statement II is true. |

97. Assertion (A): Chilled ethanol is added at the end of the purification protocol to precipitate out clean genomic DNA. Reason (R): DNA is completely insoluble in cold alcohol/ethanol solutions, causing it to aggregate into visible fine threads.

- | | |
|--|--|
| 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. |

98. If a cloning plasmid lacks a functional Origin of Replication (ori) sequence, what will be the fate of this vector when introduced into a competent host cell?

- | | |
|--|--|
| A) The plasmid will integrate into the host chromosome at a higher frequency. | B) The host cell will translate the plasmid proteins at double the normal rate. |
| C) The plasmid will fail to replicate within the host cell and will be lost during cell division. | D) The host cell will immediately undergo spontaneous lysis. |

99. To view DNA bands on an agarose gel, the gel must be stained with _____ and exposed to _____ radiation.

- | | |
|---|---|
| A) Methylene Blue, Infrared | B) Ethidium Bromide, Ultraviolet |
| C) Bromophenol Blue, Visible Light | D) Acetocarmine, X-Ray |

100.

If a single double-stranded DNA molecule is used as a template in a PCR machine, how many copies of this specific target region will be generated after 4 complete operational cycles?

- | | |
|---------------------|---------------------|
| A) 8 copies | B) 16 copies |
| C) 32 copies | D) 64 copies |

101.

Which of the following parameters must be continuously monitored and dynamically maintained by operational control systems within an active bioreactor to ensure optimal product yield?

- | | |
|---|---|
| A) Temperature and pH | B) Oxygen concentration and substrate levels |
| C) Salts, vitamins, and foam stability | D) All of the above |

- 102.**
What exactly happens during the 'Elution' step of agarose gel electrophoresis?
- A) DNA is stained with ethidium bromide to make bands visible. B) The separated DNA band is cut out from the agarose gel piece and extracted from the gel matrix.
C) Denatured single strands of DNA are re-annealed using ligase enzymes. D) High voltage is applied to cause fast migration of small fragments.
- 103.**
The core technique that enabled the birth of modern biotechnology is:
- A) Genetic engineering B) Maintenance of sterile ambience in chemical engineering
C) Both A and B D) None of the above
- 104.**
The concept of traditional biotechnology is primarily based on:
- A) Recombinant DNA technology B) Using natural capabilities of microorganisms
C) Gene cloning D) Polymerase Chain Reaction
- 105.**
The two main domains of genetic engineering are:
- A) Tissue culture and transformation B) Altering genetic material and introducing it into host organisms
C) Fermentation and distillation D) Hybridization and cross-breeding
- 106.**
An enzyme that cleaves the phosphodiester backbone within a DNA molecule is known as:
- A) Exonuclease B) Endonuclease
C) Ligase D) Polymerase
- 107.**
The Roman numeral 'I' in EcoRI indicates:
- A) The genus number B) The order in which the enzyme was isolated from the strain
C) The number of active sites D) The molecular weight class
- 108.**
In agarose gel electrophoresis, DNA fragments move towards which electrode?
- A) Anode (Positive electrode) B) Cathode (Negative electrode)
C) Neutral electrode D) It remains stationary
- 109.**
The matrix commonly used in gel electrophoresis of DNA is agarose, which is extracted from:
- A) Seaweeds B) Lichens
C) Fungi D) Ferns
- 110.**
DNA fragments separate during gel electrophoresis based on their:
- A) Charge only B) Size/length only
C) Charge-to-size ratio D) Sequence composition
- 111.**
A DNA molecule used as a vehicle to artificially carry foreign genetic material into another cell is a:
- A) Exon B) Vector
C) Intron D) Cistron
- 112.**
Selectable markers in a cloning vector help to:
- A) Identify and eliminate non-transformants B) Initiate transcription
C) Increase the copy number of the plasmid D) Denature the foreign DNA
- 113.**
If a foreign gene is ligated at the EcoRI site in pBR322, the recombinant plasmid will:
- A) Gain ampicillin resistance B) Lose tetracycline resistance
C) Lose ampicillin resistance D) None of the above
- 114.**
To make bacterial cells competent to take up plasmid DNA, they are treated with a specific concentration of a divalent cation like:
- A) Sodium B) Magnesium
C) Calcium D) Potassium
- 115.**
The process of introducing foreign DNA into a bacterial host cell is termed:
- A) Transduction B) Transformation
C) Ligation D) Cloning
- 116.**
The optimal temperature for the extension step of PCR catalyzed by Taq polymerase is:
- A) 94°C B) 72°C
C) 50°C D) 37°C
- 117.**
The stage that includes separation and purification steps before a biotechnological product is marketed is called:
- A) Upstream processing B) Downstream processing
C) Bioprocessing D) Postproduction processing
- 118.**
The concept that forms the foundation of modern biotechnology is integration of natural science and organisms, which was given by:
- A) NIH B) EFB
C) WHO D) GEAC

119.

The sticky ends formed after restriction digestion readily join together due to the activity of:

- A) DNA Polymerase I B) RNA Primase
C) DNA Ligase D) Alkaline Phosphatase

120.

Insertional inactivation of the beta-galactosidase gene by a foreign DNA insert leads to colonies appearing:

- A) Blue in color B) Bright orange in color
C) White D) Dark red in color

121.

Consider the following statements regarding standard Restriction Endonucleases: Statement I: They cut the two strands of DNA at the exact center of the palindromic site. Statement II: They break the hydrogen bonds between bases directly to generate sticky ends.

- 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

122.

Analyze the statements regarding PCR (Polymerase Chain Reaction): Statement I: Taq polymerase is selected because it stays active even at high denaturation temperatures. Statement II: Primers are long, double-stranded RNA blocks that match the center of target DNA.

- 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

123.

Statement I: Recombinant DNA technology can successfully introduce genes between taxonomically unrelated organisms. Statement II: Traditional hybridization always limits genetic variation to the pre-existing species gene pool.

- 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.

Match Column I (Antibiotic Selection Scenario) with Column II (Phenotypic Outcome for pBR322 Recombinants): Choose the correct matching arrangement:

Column-I	Column-II
(p) Insert at <u>Bam</u> HI site	(i) Loses tetracycline resistance
(q) Insert at <u>Pst</u> I site	(ii) Loses ampicillin resistance
(r) No insert introduced	(iii) Retains both resistances
(s) Insert at <u>Eco</u> RI site outside markers	(iv) Retains both marker resistances

- A) p-iv, q-ii, r-iii, s-i B) p-ii, q-i, r-iii, s-iv
C) p-i, q-iii, r-ii, s-iv D) p-i, q-ii, r-iii, s-iv

125.

Assertion (A): Taq DNA polymerase is used instead of normal human DNA polymerase in PCR reactions.

Reason (R): Polymerase chain reaction involves a high-temperature step that denatures standard proteins. Directions:

- 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

126.

Match Column I (Enzyme/Tool) with Column II (Function/Source): Choose the correct matching arrangement:

Column-I	Column-II
(p) <u>Eco</u> RI	(iv) Cuts at 5'-GAATTC-3'
(q) Exonuclease	(i) Removes nucleotides from ends
(r) Chitinase	(iii) Fungal cell wall digestion
(s) Taq Polymerase	(ii) <i>Thermus aquaticus</i>

- A) p-i, q-iv, r-iii, s-ii B) p-iv, q-i, r-iii, s-ii
C) p-iv, q-iii, r-i, s-ii D) p-ii, q-i, r-iii, s-iv

127.

Match Column I (PCR Phase) with Column II (Temperature Condition): Choose the correct matching arrangement:

Column-I	Column-II
(P) Denaturation	(iii) 94 degrees C
(Q) Annealing	(i) 50-60 degrees C
(R) Extension	(ii) 72 degrees C
(S) Storage	(iv) 4 degrees C

- A) p-iii, q-i, r-ii, s-iv B) p-i, q-iii, r-ii, s-iv
C) p-iii, q-ii, r-i, s-iv D) p-ii, q-i, r-iii, s-iv

128.

Match Column I (Downstream Phase Component) with Column II (Target Objective):

Column-I	Column-II
(p) Separation	(i) Removing biomass debris
(q) Purification	(ii) Achieving high chemical homogeneity
(r) Formulation	(iii) Adding stabilizers/preservatives
(s) Quality Control	(iv) Safety and efficacy validation

- A) p-i, q-ii, r-iii, s-iv B) p-ii, q-i, r-iii, s-iv
C) p-i, q-iii, r-ii, s-iv D) p-iv, q-ii, r-iii, s-i

129.

Which class of enzymes is responsible for cleaving nucleotides from the absolute terminal ends of a DNA strand?

- A) Endonucleases B) Exonucleases
C) Ligases D) Methylases

130.

Which of the following is considered the heart of biotechnology techniques?

- A) Traditional micro-propagation B) Recombinant DNA technology
C) Large scale plant hybridization D) Classical animal husbandry

131.

In the restriction enzyme EcoRI, the letter 'R' specifically stands for:

- A) Order of discovery B) Genus name
C) Species identifier D) Bacterial strain name

132.

The first restriction endonuclease to be isolated and studied was:

- A) EcoRI B) HindII
C) BamHI D) PstI

133.

Assertion (A): Smaller DNA fragments travel much farther down the agarose gel matrix than larger fragments. Reason (R): The agarose gel acts as a sieve, separating fragments based purely on their size.

Directions: Choose the most appropriate choice from the following options:

- 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

134.

Assertion (A): Agrobacterium tumefaciens can naturally induce tumors or galls in monocotyledonous crop plants. Reason (R): The T-DNA region of the Ti plasmid contains genes that direct the host cell to synthesize tumor-inducing hormones. Directions:

- 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 false but R is true D) A is true but R is false

135.

Assertion (A): Chitinase enzyme is used when isolating genomic DNA from plant cells like onions.

Reason (R): The cell walls of plants are composed primarily of cross-linked cellulose microfibrils.

Directions:

- 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 false but R is true D) A is true but R is false

Zoology

136.

Polygenic inheritance Consider the following statements regarding polygenic inheritance: 1. A trait may be controlled by two or more genes. 2. The phenotype is generally influenced by the cumulative effect of several genes. 3. Human skin colour is cited by NCERT as an example of polygenic inheritance. 4. Such inheritance generally produces discontinuous phenotypic classes. Which of the statements given above are correct?

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

137.

Human skin colour In the classical explanation of human skin colour inheritance, consider the following statements: 1. Skin colour is controlled by multiple genes. 2. The effect of each contributing allele is cumulative. 3. Individuals with different combinations of contributing alleles may exhibit intermediate phenotypes. 4. The inheritance pattern resembles a typical single-gene Mendelian trait with only two phenotypic classes. Which combination is correct?

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

138.

A gene is said to exhibit pleiotropy when: 1. A single gene influences more than one phenotypic trait. 2. The same gene can have effects on apparently unrelated characters. 3. One gene must always interact with several alleles at the same locus. 4. A single mutation can consequently produce several phenotypic effects. Choose the correct answer.

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

139.

Pleiotropy and phenotypic expression Which of the following statements most appropriately distinguishes pleiotropy from polygenic inheritance?

- A) Pleiotropy involves many genes controlling one character, whereas polygenic inheritance involves one gene controlling many characters. B) Pleiotropy involves one gene affecting several characters, whereas polygenic inheritance involves several genes contributing to a single character. C) Both phenomena necessarily involve multiple alleles at the same locus. D) Both phenomena produce only discontinuous variation.

140.

Sex determination in humans Consider the following statements: 1. Human females have XX sex chromosomes. 2. Human males have XY sex chromosomes. 3. All ova produced by a human female normally carry an X chromosome. 4. Human males produce two types of gametes with respect to sex chromosomes. 5. The sex of the offspring is determined by the chromosome contributed by the mother. Which statements are correct?

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

141.

Human sex determination A couple has a child Regarding the chromosomal basis of sex determination, which statement is most appropriate?

- A) The mother determines the sex because all her ova contain either X or Y. B) The father determines the sex because his sperm may carry either X or Y chromosome. C) Both parents produce equal numbers of X- and Y-bearing gametes. D) The sex chromosome composition of the ovum changes depending on the sperm that fertilises it.

142.

Consider the following statements about mutation: 1. Mutation refers to a change in the genetic material. 2. Mutations may occur spontaneously. 3. Mutations may also be induced by certain physical or chemical agents. 4. Mutations are always harmful to the organism. 5. Mutations can contribute to genetic variation. Which statements are correct?

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

143.

A mutation involving a change in a single base pair of DNA is best described as:

- A) Polygenic inheritance B) Point mutation C) Aneuploidy D) Polyploidy

144.

Consider the following statements regarding sickle-cell anaemia: 1. It is caused by a point mutation. 2. The mutation results in a change in the β -globin chain of haemoglobin. 3. The sixth amino acid of the β -globin chain is affected 4. Glutamic acid is replaced by valine. 5. It is caused by trisomy of chromosome 21. Which statements are correct?

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

145.

Which of the following statements correctly characterises genetic disorders? 1. They may result from mutations in genes. 2. They may also result from chromosomal abnormalities. 3. Some are inherited from parents. 4. All genetic disorders are necessarily caused by changes in chromosome number.

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

146.

Down's syndrome A child presents with characteristic features associated with Down's syndrome. Which of the following statements are correct? 1. It is caused by trisomy of chromosome 21. 2. It results from an abnormality in chromosome number. 3. It may arise due to non-disjunction during cell division. 4. The individual has one additional copy of chromosome 21.

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

147.

Klinefelter's syndrome Which combination correctly describes Klinefelter's syndrome?

- A) 45, XO — sterile female B) 47, XXY — sterile male C) 47, XYY — sterile female D) 47, XXX — sterile male

148.

Turner syndrome Consider the following statements: 1. Turner syndrome is associated with XO chromosomal constitution. 2. Such individuals are phenotypically female. 3. They generally have rudimentary ovaries. 4. They are usually sterile. 4. Their chromosome number is 47. Which are correct?

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

149.

Match Column I with Column II:

Column I	Column II
P. Down's syndrome	1. XO
Q. Klinefelter's syndrome	2. Trisomy 21
R. Turner syndrome	3. XXY

- A) P-2, Q-3, R-1 B) P-1, Q-2, R-3 C) P-3, Q-1, R-2 D) P-2, Q-1, R-3

150.

Match the disorder with its characteristic

Column I	Column II
P. Down's syndrome	1. XO
Q. Klinefelter's syndrome	2. Trisomy 21
R. Turner syndrome	3. XXY
S. Sickle-cell anaemia	4. β -globin gene mutation

- A) P-2, Q-3, R-1, S-4 B) P-3, Q-2, R-1, S-4
C) P-2, Q-1, R-3, S-4 D) P-1, Q-3, R-2, S-4

151.

Match the terms

Column I	Column II
P. Polygenic inheritance	1. One gene affects several characters
Q. Pleiotropy	2. Several genes influence one character
R. Point mutation	3. Change involving a single base pair
S. Aneuploidy	4. Gain or loss of chromosomes

- A) P-2, Q-1, R-3, S-4 B) P-1, Q-2, R-4, S-3
C) P-2, Q-3, R-1, S-4 D) P-4, Q-1, R-3, S-2

152.

Match the syndrome with chromosomal constitution

Column I	Column II
P. Normal female	1. XY
Q. Normal male	2. XX
R. Turner syndrome	3. XO
S. Klinefelter's syndrome	4. XXY

- A) P-2, Q-1, R-3, S-4 B) P-1, Q-2, R-3, S-4
C) P-2, Q-3, R-1, S-4 D) P-4, Q-1, R-3, S-2

153.

Match the genetic condition with its basis

Column I	Column II
P. Sickle-cell anaemia	1. Trisomy
Q. Down's syndrome	2. Point mutation
R. Turner syndrome	3. Monosomy
S. Klinefelter's syndrome	4. Extra X chromosome in male

- A) P-2, Q-1, R-3, S-4 B) P-1, Q-2, R-3, S-4
C) P-2, Q-3, R-1, S-4 D) P-3, Q-1, R-2, S-4

154.

Match

Column I	Column II
P. Human skin colour	1. Pleiotropy
Q. Sickle-cell anaemia	2. Polygenic inheritance
R. Phenylketonuria	3. Inborn error of metabolism
S. Down's syndrome	4. Chromosomal abnormality

- A) P-2, Q-3, R-1, S-4 B) P-2, Q-1, R-3, S-4
C) P-1, Q-2, R-3, S-4 D) P-2, Q-3, R-4, S-1

155.

Assertion (A): Human skin colour is considered an example of polygenic inheritance. **Reason (R):** Skin colour is determined by the cumulative effect of more than one gene.

- 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.

156.

Assertion (A): Human males are considered heterogametic. **Reason (R):** Human males produce two types of sperms with respect to sex 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) A is false but R is true.

157.

Assertion (A): Sickle-cell anaemia is a genetic disorder caused by a point mutation. **Reason (R):** A single base substitution in the β -globin gene changes the amino acid sequence of the β -globin chain.

- 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.

158.

Assertion (A): Turner syndrome is associated with monosomy. **Reason (R):** Individuals with Turner syndrome possess only one X chromosome.

- 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.

159.

Assertion (A): Klinefelter's syndrome occurs due to an abnormality in chromosome number. **Reason (R):** Affected males possess an additional X chromosome.

- 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.

160.

Which one of the following correctly represents the flow of events associated with sickle-cell anaemia?

- A) Gene mutation → altered β-globin → altered haemoglobin → sickle-shaped RBCs under low oxygen conditions
 B) Chromosome 21 trisomy → altered β-globin → sickle-shaped RBCs
 C) XO condition → abnormal haemoglobin → sickling
 D) Polygenic inheritance → β-globin mutation → Down's syndrome

161.

A student makes the following statements: 1. Mutation is the ultimate source of genetic variation. 2. Mutations can be spontaneous. 3. Mutations can be induced using mutagens. 4. Mutagens are always biological organisms. 5. UV radiation can act as a physical mutagen. Which statements should the teacher mark as correct?

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

162.

Which of the following combinations is incorrect?

- A) Polygenic inheritance — cumulative effect of several genes
 B) Pleiotropy — one gene affects several characters
 C) Turner syndrome — 47, XXY
 D) Klinefelter's syndrome — 47, XXY

163.

A male child inherits the Y chromosome from his father and an X chromosome from his mother. Which statement follows from this observation?

- A) The mother is heterogametic
 B) The father is heterogametic
 C) The father produces only X-bearing sperm.
 D) The mother produces X- and Y-bearing ova

164.

A geneticist observes that increasing the number of contributing alleles results in progressively greater expression of a character. The inheritance pattern is most likely:

- A) Multiple allelism
 B) Polygenic inheritance
 C) Pleiotropy
 D) Codominance

165.

A mutation changes one nucleotide in a gene and consequently changes a codon. Which category does this mutation most directly represent?

- A) Point mutation
 B) Polyploidy
 C) Aneuploidy
 D) Polygenic inheritance

166.

Match the following:

Column I	Column II
P. Human skin colour	1. Single gene-multiple effects
Q. Pleiotropy	2. Multiple genes-one character
R. Sickle-cell anaemia	3. β-globin mutation
S. Down's syndrome	4. Trisomy 21

- A) P-2, Q-1, R-3, S-4
 B) P-1, Q-2, R-4, S-3
 C) P-2, Q-3, R-1, S-4
 D) P-3, Q-1, R-2, S-4

167.

Match the following terms with their most appropriate descriptions:

Column I	Column II
P. Heterogametic sex	1. Produces two types of gametes with respect to sex chromosomes
Q. Homogametic sex	2. Produces one type of gamete with respect to sex chromosomes
R. Aneuploidy	3. Abnormality involving gain or loss of one or more chromosomes
S. Mutation	4. Change in genetic material

- A) P-1, Q-2, R-3, S-4
 B) P-2, Q-1, R-4, S-3
 C) P-1, Q-3, R-2, S-4
 D) P-4, Q-2, R-3, S-1

168.

Match the disorder with the appropriate description:

Column I	Column II
P. Phenylketonuria	1. Autosomal recessive disorder
Q. Sickle-cell anaemia	2. Point mutation
R. Down's syndrome	3. Trisomy 21
S. Turner syndrome	4. XO

- A) P-1, Q-2, R-3, S-4
 B) P-2, Q-1, R-4, S-3
 C) P-1, Q-3, R-2, S-4
 D) P-4, Q-2, R-3, S-1

169.

Match the following:

Column I	Column II
P. Klinefelter's syndrome	1. Male
Q. Turner syndrome	2. Female
R. Down's syndrome	3. Autosomal chromosomal disorder
S. Sickle-cell anaemia	4. Molecular genetic disorder

- A) P-1, Q-2, R-3, S-4
 B) P-2, Q-1, R-3, S-4
 C) P-1, Q-3, R-2, S-4
 D) P-4, Q-2, R-3, S-1

170.

Which of the following statements regarding polygenic inheritance is incorrect?

- A) It involves several genes contributing to a single character. B) The phenotype can show continuous variation.
- C) The effect of individual genes may be cumulative. D) It necessarily involves one gene producing several unrelated phenotypes.

171.

Which one of the following pairs is correctly matched?

- A) Pleiotropy — several genes control one character B) Polygenic inheritance — one gene controls several characters
- C) Sickle-cell anaemia — point mutation D) Turner syndrome — trisomy 21

172.

Which statement about the human male sex chromosome constitution is correct?

- A) Male is homogametic because all sperms carry X. B) Male is heterogametic because sperms may carry either X or Y.
- C) Male is heterogametic because ova carry X or Y. D) Male is homogametic because all body cells contain XY.

173.

If non-disjunction occurs during gamete formation, which of the following may result?

- A) Alteration in chromosome number B) Always a point mutation
- C) Polygenic inheritance D) Pleiotropy

174.

Which of the following is not correctly associated with Down's syndrome?

- A) Trisomy 21 B) Chromosomal abnormality
- C) Presence of an additional chromosome 21 D) Monosomy of X chromosome

175.

A person possesses 47 chromosomes with an XXY constitution. Which conclusion is most appropriate?

- A) Turner syndrome B) Klinefelter's syndrome
- C) Down's syndrome D) Sickle-cell anaemia

176.

Read the following statements carefully: 1. Genetic disorders may be broadly grouped into Mendelian disorders and chromosomal disorders. 2. Mendelian disorders are caused by alteration or mutation in a single gene. 3. Chromosomal disorders are caused due to absence or excess or abnormal arrangement of one or more chromosomes. 4. Down's syndrome is a Mendelian disorder. Which option is correct?

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

177.

Consider the following statements concerning Mendelian disorders: 1. They may be transmitted from one generation to another 2. They may be caused by mutation in a single gene. 3. Haemophilia is an example. 4. Sickle-cell anaemia is an example. 5. Down's syndrome is a typical Mendelian disorder. Choose the correct combination.

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

178.

A disorder is caused by an abnormality in chromosome number rather than by alteration of a single nucleotide sequence. Which of the following would be the most appropriate examples?

- A) Sickle-cell anaemia and phenylketonuria B) Down's syndrome and Turner syndrome
- C) Haemophilia and sickle-cell anaemia D) Phenylketonuria and thalassemia

179.

Assertion–Reason Assertion (A): A mutation can sometimes have effects on more than one phenotypic character. Reason (R): A single gene may participate in the expression of multiple phenotypic traits.

- 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.

180.

A researcher studies five observations: P: One gene influences several phenotypic characters. Q: Several genes contribute cumulatively to a single character. R: A single nucleotide substitution alters the β -globin protein S: An individual possesses three copies of chromosome 21. T: An individual has only one X chromosome and is phenotypically female. Which option correctly identifies P, Q, R, S and T, respectively?

- A) Pleiotropy, polygenic inheritance, point mutation, Down's syndrome, Turner syndrome B) Polygenic inheritance, pleiotropy, point mutation, Turner syndrome, Down's syndrome
- C) Pleiotropy, multiple allelism, chromosomal mutation, Klinefelter's syndrome, Turner syndrome D) Multiple allelism, polygenic inheritance, point mutation, Down's syndrome, Klinefelter's syndrome

ANSWER KEY

Physics

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

Chemistry

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

Botany

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

Zoology

136.	1	140.	1	144.	2	148.	2
137.	1	141.	2	145.	1	149.	1
138.	2	142.	2	146.	4	150.	1
139.	2	143.	2	147.	2	151.	1

152.	1	160.	1	168.	1	176.	1
153.	1	161.	2	169.	1	177.	2
154.	2	162.	3	170.	4	178.	2
155.	1	163.	2	171.	3	179.	1
156.	1	164.	2	172.	2	180.	1
157.	1	165.	1	173.	1		
158.	1	166.	1	174.	4		
159.	1	167.	1	175.	2		

SOLUTIONS

Q1.

Answer: A

Explanation:

Apply the LCR series circuit voltage relationship formula:

$V^2 = V_3^2 + (V_1 - V_2)^2$ Substitute the given values ($V = 250$ V, $V_1 = 400$ V, $V_2 = 250$ V): $(250)^2 = V_3^2 + (400 - 250)^2$
Calculate: $62500 = V_3^2 + (150)^2$ $62500 = V_3^2 + 22500$ Solve for V_3 : $V_3^2 = 62500 - 22500 = 40000$ $V_3 = \sqrt{40000} = 200$ V
Calculate the current using Ohm's law: $I = \frac{V_3}{R} = \frac{200}{250} = 0.8$ A

Q2.

Answer: B

Explanation:

With dc, the coil offers only its resistance, so

$R = V/I_{dc} = 24/4 = 6$ Ω . With ac, the coil offers impedance

$Z = V/I_{ac} = 24/2.4 = 10$ Ω . Using $Z^2 = R^2 + (\omega L)^2$, the

reactance is $\omega L = \sqrt{10^2 - 6^2} = 8$ Ω , giving $L = 8/40 = 0.2$ H
 $= 200$ mH.

Q3.

Answer: B

Explanation:

The impedance of the coil is

$Z = \sqrt{R^2 + X_L^2} = \sqrt{300^2 + 300^2} = 300\sqrt{2}$ Ω . The peak

voltage is $V_0 = \sqrt{2} \times 600$ V, so the maximum current is

$I_0 = V_0/Z = (600\sqrt{2})/(300\sqrt{2}) = 2$ A. The phase angle is

$\phi = \tan^{-1}(X_L/R) = 45^\circ = \pi/4$, giving a time lag

$t = \phi/\omega = (\pi/4)/(2\pi \times 25) = 1/200$ s $= 5$ ms.

Q4.

Answer: C

Explanation:

Using $X_L = \omega L$, $X_C = \frac{1}{\omega C}$ and $\tan \phi = \frac{|X_L - X_C|}{R}$: (A) $X_C = 10$

Ω with $R = 10\sqrt{3}$ Ω gives $\tan \phi = \frac{1}{\sqrt{3}}$, so $\phi = \frac{\pi}{6}$ (q). (B) Pure

inductor gives $\phi = \frac{\pi}{2}$ (p). (C) Pure capacitor gives $\phi = \frac{\pi}{2}$ (p). (D)

$X_L = 10\sqrt{3}$ Ω with $R = 10$ Ω gives $\tan \phi = \sqrt{3}$, so $\phi = \frac{\pi}{3}$ (s).

(E) $X_L = X_C = 20$ Ω , resonance, so $\phi = 0$ (t).

Q5.

Answer: C

Explanation:

The rms voltage is $E_{rms} = \frac{200}{\sqrt{2}} = 100\sqrt{2}$ V. The net reactance is

$X_L - X_C = 40 - 20 = 20$ Ω , so the impedance is

$Z = \sqrt{20^2 + 20^2} = 20\sqrt{2}$ Ω . The ammeter reads

$I_{rms} = \frac{100\sqrt{2}}{20\sqrt{2}} = 5$ A, giving $V_R = 5 \times 20 = 100$ V and

$V_C = 5 \times 20 = 100$ V.

Q6.

Answer: C

Explanation:

The rms source voltage is $E_{rms} = \frac{100}{\sqrt{2}} = 50\sqrt{2}$ V. The net

reactance of the L-C branch is $X_L - X_C = 30 - 20 = 10$ Ω , so

the impedance is $Z = \sqrt{10^2 + 10^2} = 10\sqrt{2}$ Ω . The ammeter

reads $I_{rms} = \frac{50\sqrt{2}}{10\sqrt{2}} = 5$ A, and the voltmeter across the L-C

combination reads $V = I_{rms}(X_L - X_C) = 5 \times 10 = 50$ V.

Q7.

Answer: B

Explanation:

In a parallel combination the same voltage $V = V_0 \cos \omega t$ appears across each element. The resistor current is in phase,

$i_R = \frac{V}{R} = \frac{V_0}{R} \cos \omega t$. The inductor current is

$i_L = \frac{1}{L} \int V dt = \frac{V_0}{\omega L} \sin \omega t$ (lags by 90 degrees). The capacitor current is $i_C = C \frac{dV}{dt} = -V_0 \omega C \sin \omega t$ (leads by 90 degrees).

Q8.

Answer: B

Explanation:

At resonance the angular frequency is

$\omega_r = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{4.0 \times 25 \times 10^{-6}}} = \frac{1}{\sqrt{10^{-4}}} = 100$ rad/s. At resonance

the impedance reduces to $Z = R$, so the current amplitude is

$I_0 = \frac{V_0}{R} = \frac{250}{50} = 5$ A.

Q9.

Answer: B

Explanation:

The current is maximum at resonance, where

$\omega_r = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{0.1 \times 100 \times 10^{-9}}} = 10^4$ rad/s, so

$f_r = \frac{\omega_r}{2\pi} = \frac{10^4}{2\pi} \approx 1.59 \times 10^3$ Hz. The Q-factor is

$Q = \frac{\omega_r L}{R} = \frac{10^4 \times 0.1}{40} = 25$.

Q10.

Answer: C

Explanation:

The rms voltage is $V_{rms} = \frac{100\sqrt{2}}{\sqrt{2}} = 100$ V. Since the circuit

contains only the inductor, $X_L = \frac{V_{rms}}{I_{rms}} = \frac{100}{4} = 25$ Ω . With

$\omega = 200\pi$ rad/s, the inductance is $L = \frac{X_L}{\omega} = \frac{25}{200\pi} = \frac{1}{8\pi}$ H.

Q11.

Answer: D

Explanation:

The impedance of a pure inductor is

$Z = X_L = \omega L = 2\pi f L = 2\pi \times 50 \times \frac{20}{\pi} \times 10^{-3} = 2$ Ω . The

rms current is $I_{rms} = \frac{V}{Z} = \frac{100}{2} = 50$ A, the peak current is

$I_0 = \sqrt{2} \times 50 = 50\sqrt{2}$ A, and since the current lags the voltage

by $\frac{\pi}{2}$ in a pure inductor, $I = 50\sqrt{2} \sin(100\pi t - \frac{\pi}{2})$.

Q12.

Answer: B

Explanation:

For a pure inductor the impedance is $Z = \omega L$, so each Z versus ω line is straight with slope equal to the inductance L . Therefore

$\frac{L_1}{L_2} = \frac{\tan 60^\circ}{\tan 45^\circ} = \frac{\sqrt{3}}{1} = \sqrt{3}$.

Q13.

Answer: B

Explanation:

For a series RC circuit the impedance is

$Z = \sqrt{R^2 + X_C^2} = \sqrt{60^2 + 80^2} = \sqrt{3600 + 6400} = \sqrt{10000} = 100$ Ω .

Q14.**Answer:** D**Explanation:**

For a series RL circuit the impedance is

$$Z = \sqrt{R^2 + X_L^2} = \sqrt{9^2 + 12^2} = \sqrt{81 + 144} = \sqrt{225} = 15 \Omega.$$

Q15.**Answer:** B**Explanation:**

The bulb runs safely at its rated values, so the current is

$$I = \frac{P}{V_R} = \frac{12}{60} = 0.2 \text{ A. The inductor must take the remaining}$$

$$\text{voltage: } V_L = \sqrt{V^2 - V_R^2} = \sqrt{100^2 - 60^2} = 80 \text{ V. Hence}$$

$$X_L = \frac{V_L}{I} = \frac{80}{0.2} = 400 \Omega, \text{ and } L = \frac{X_L}{2\pi f} = \frac{400}{100\pi} = \frac{4}{\pi} \text{ H.}$$

Q16.**Answer:** B**Explanation:**

The bulb runs safely at its rated values, so the current is

$$I = \frac{P}{V_R} = \frac{16}{80} = 0.2 \text{ A. The inductor must take the remaining}$$

$$\text{voltage: } V_L = \sqrt{V^2 - V_R^2} = \sqrt{100^2 - 80^2} = 60 \text{ V. Hence}$$

$$X_L = \frac{V_L}{I} = \frac{60}{0.2} = 300 \Omega, \text{ and } L = \frac{X_L}{2\pi f} = \frac{300}{100\pi} = \frac{3}{\pi} \text{ H.}$$

Q17.**Answer:** C**Explanation:**The inductive reactance is $X_L = \omega L = 500 \times 20 \times 10^{-3} = 10 \Omega$

, so the peak current is $I_0 = \frac{E_0}{X_L} = \frac{100}{10} = 10 \text{ A}$. In a pure inductor the current lags the voltage by $\frac{\pi}{2}$, giving $I = 10 \sin(500t - \frac{\pi}{2}) \text{ A}$.

Q18.**Answer:** D**Explanation:**

The inductive reactance is $X_L = \omega L = 2500 \times 20 \times 10^{-3} = 50 \Omega$, so the peak current is $I_0 = \frac{E_0}{X_L} = \frac{250}{50} = 5 \text{ A}$. In a pure inductor the current lags the voltage by $\frac{\pi}{2}$, giving $I = 5 \sin(2500t - \frac{\pi}{2}) \text{ A}$.

Q19.**Answer:** C**Explanation:**

The impedance of the circuit is $Z = \frac{V}{I} = \frac{25}{5} = 5 \Omega$. The resistance is $R = Z \cos \phi = 5 \times 0.6 = 3 \Omega$ and the inductive reactance is $X_L = Z \sin \phi = 5 \times 0.8 = 4 \Omega$.

Q20.**Answer:** C**Explanation:**

The current lags the source voltage by $\phi = \frac{\pi}{4}$. For a series RL circuit, $\tan \phi = \frac{X_L}{R}$, so $X_L = R \tan \frac{\pi}{4} = 100 \times 1 = 100 \Omega$. With $\omega = 200 \text{ rad/s}$, the inductance is $L = \frac{X_L}{\omega} = \frac{100}{200} = 0.5 \text{ H}$.

Q21.**Answer:** C**Explanation:**

$$\text{The capacitive reactance is } X_C = \frac{1}{\omega C} = \frac{1}{2\pi \times 50 \times \frac{50}{\pi} \times 10^{-6}} = 200 \Omega$$

$$\text{. The impedance is } Z = \sqrt{R^2 + X_C^2} = \sqrt{150^2 + 200^2} = 250 \Omega,$$

so the power factor is $\cos \phi = \frac{R}{Z} = \frac{150}{250} = 0.6$. The current is

$$I = \frac{V}{Z} = \frac{200}{250} = 0.8 \text{ A, giving power dissipated}$$

$$P = I^2 R = 0.64 \times 150 = 96 \text{ W.}$$

Q22.**Answer:** A**Explanation:**

Substituting the time, the phase angle is $600\pi \times \frac{1}{3600} = \frac{\pi}{6}$, so $V = 200 \sin \frac{\pi}{6} = 200 \times \frac{1}{2} = 100 \text{ V}$.

Q23.**Answer:** C**Explanation:**

Substituting the time, the phase angle is $800\pi \times \frac{1}{3200} = \frac{\pi}{4}$, so $V = 400 \sin \frac{\pi}{4} = 400 \times \frac{1}{\sqrt{2}} = 200\sqrt{2} \text{ V}$.

Q24.**Answer:** B**Explanation:**

The RMS value is $I_{rms} = \sqrt{\langle I^2 \rangle}$. For (i), using $\langle \cos^2 \omega t \rangle = \langle \sin^2 \omega t \rangle = \frac{1}{2}$ and $\langle \sin \omega t \cos \omega t \rangle = 0$, we get

$$\langle I^2 \rangle = \frac{a^2}{2} + \frac{b^2}{2}, \text{ so } I_{rms} = \sqrt{\frac{a^2}{2} + \frac{b^2}{2}}. \text{ For (ii), using}$$

$$\langle \cos \omega t \rangle = 0 \text{ and } \langle \cos^2 \omega t \rangle = \frac{1}{2}, \text{ we get } \langle I^2 \rangle = a^2 + \frac{b^2}{2}, \text{ so}$$

$$I_{rms} = \sqrt{a^2 + \frac{b^2}{2}}.$$

Q25.**Answer:** C**Explanation:**

The angular frequency is $\omega = 314 \text{ rad/s}$, so the time period is $T = \frac{2\pi}{\omega} = \frac{6.28}{314} = 0.02 \text{ s}$. The phase difference between voltage and current is $\Delta\phi = 45^\circ - (-45^\circ) = 90^\circ$.

Q26.**Answer:** B**Explanation:**

Adding the two phasors with equal amplitude V_0 and phase difference $\frac{\pi}{2}$: the resultant amplitude is

$$\sqrt{V_0^2 + V_0^2 + 2V_0^2 \cos \frac{\pi}{2}} = \sqrt{2}V_0, \text{ and since the amplitudes are equal the resultant lies midway in phase, at } \frac{\pi}{4}. \text{ Hence the resultant is } \sqrt{2}V_0 \sin(\omega t + \frac{\pi}{4}).$$

Q27.**Answer:** C**Explanation:**1. Calculate the Resultant Amplitude (V_R):

Using the phasor addition formula:

$$V_R = \sqrt{V_1^2 + V_2^2 + 2V_1V_2 \cos \Delta\phi}$$

Here, $V_1 = V_0$, $V_2 = V_0$, and $\Delta\phi = \frac{\pi}{3}$ ($\cos \frac{\pi}{3} = \frac{1}{2}$):

$$V_R = \sqrt{V_0^2 + V_0^2 + 2V_0^2 \left(\frac{1}{2}\right)} = \sqrt{3V_0^2} = \sqrt{3}V_0$$

2. Determine the Phase Angle (θ):Since both voltages have equal amplitude V_0 , the resultant phase angle bisects the phase difference $\Delta\phi$:

$$\theta = \frac{\Delta\phi}{2} = \frac{\pi/3}{2} = \frac{\pi}{6}$$

3. Resultant Voltage Equation:

$$V = V_R \sin(\omega t + \theta) = \sqrt{3}V_0 \sin\left(\omega t + \frac{\pi}{6}\right)$$

Q28.**Answer:** B**Explanation:**The two phasors have equal amplitude V_0 and phase difference $\frac{\pi}{2}$.The resultant amplitude is $\sqrt{V_0^2 + V_0^2 + 2V_0^2 \cos \frac{\pi}{2}} = \sqrt{2}V_0$, and the resultant phase lies midway at $\frac{\pi}{4}$. Hence the resultant is $\sqrt{2}V_0 \sin(\omega t + \frac{\pi}{4})$.**Q29.****Answer:** A**Explanation:**The two phasors have equal amplitude V_0 and phase difference $\frac{2\pi}{3}$.

The resultant amplitude is

$$\sqrt{V_0^2 + V_0^2 + 2V_0^2 \cos \frac{2\pi}{3}} = \sqrt{2V_0^2 - V_0^2} = V_0$$

and the resultant phase lies midway at $\frac{\pi}{3}$. Hence the resultant is $V_0 \sin(\omega t + \frac{\pi}{3})$.

Q30.**Answer:** C**Explanation:**

The ac ammeter reads the rms current. The rms voltage is

$$V_{rms} = \frac{V_0}{\sqrt{2}} = \frac{100}{\sqrt{2}} = 70.7 \text{ V, so the ammeter reads}$$

$$I_{rms} = \frac{V_{rms}}{R} = \frac{70.7}{50} = 1.41 \text{ A.}$$

Q31.**Answer:** C**Explanation:**

The inductive reactance is $X_L = \omega L = 500 \times 40 \times 10^{-3} = 20 \Omega$, so the peak current is $I_0 = \frac{E_0}{X_L} = \frac{200}{20} = 10 \text{ A}$. In a pure inductor the current lags the voltage by $\frac{\pi}{2}$, giving $I = 10 \sin(500t - \frac{\pi}{2}) \text{ A}$.

Q32.**Answer:** A**Explanation:**

The inductive reactance is $X_L = \omega L = 5000 \times 20 \times 10^{-6} = 0.1 \Omega$, so the peak current is $I_0 = \frac{E_0}{X_L} = \frac{50}{0.1} = 500 \text{ A}$. In a pure inductor the current lags the voltage by $\frac{\pi}{2}$, giving $I = 500 \sin(5000t - \frac{\pi}{2}) \text{ A}$.

Q33.**Answer:** C**Explanation:**

The rms voltage is $E_{rms} = \frac{200\sqrt{2}}{\sqrt{2}} = 200 \text{ V}$. The inductive reactance is $X_L = \omega L = 100 \times 1 = 100 \Omega$, so the ammeter reads the rms current $I_{rms} = \frac{E_{rms}}{X_L} = \frac{200}{100} = 2 \text{ A}$.

Q34.**Answer:** C**Explanation:**

The peak current is $I_0 = \sqrt{2} \times I_{rms} = 10\sqrt{2} \text{ A}$ and the angular frequency is $\omega = 2\pi f = 2\pi \times 50 = 100\pi \text{ rad/s}$, so the equation of the alternating current is $i = 10\sqrt{2} \sin(100\pi t)$.

Q35.**Answer:** C**Explanation:**

The angular frequency is $\omega = 2\pi f = 100\pi \text{ rad/s}$, so at $t = \frac{1}{300} \text{ s}$ the phase is $\omega t = \frac{100\pi}{300} = \frac{\pi}{3}$. Hence $E = 20 \cos \frac{\pi}{3} = 20 \times \frac{1}{2} = 10 \text{ V}$.

Q36.**Answer:** B**Explanation:**

At the beginning, $t = 0$, so the current is $i = 4 \sin(\pi/6) = 4 \times \frac{1}{2} = 2 \text{ A}$.

Q37.**Answer:** C**Explanation:**

Using the identity $2 \sin \theta \cos \theta = \sin 2\theta$, the voltage becomes $V = 100 \times 2 \sin(50\pi t) \cos(50\pi t) = 100 \sin(100\pi t)$. Hence the peak voltage is 100 V (and the frequency is $\frac{100\pi}{2\pi} = 50 \text{ Hz}$, not 100 Hz).

Q38.**Answer:** B**Explanation:**

The power dissipated is

$$P = V_{rms} I_{rms} \cos \phi = \frac{V_0}{\sqrt{2}} \times \frac{I_0}{\sqrt{2}} \times \cos \frac{\pi}{3} = \frac{200 \times 0.2}{2} \times \frac{1}{2} = 20 \times \frac{1}{2} = 10 \text{ W.}$$

Q39.**Answer:** B**Explanation:**

The rms value of a combined dc and ac current is

$$I_{rms} = \sqrt{I_{dc}^2 + \frac{I_0^2}{2}} = \sqrt{2^2 + \frac{4^2}{2}} = \sqrt{4 + 8} = \sqrt{12} = 2\sqrt{3} \text{ A.}$$

Q40.**Answer:** C**Explanation:**

The phase of the voltage is $+30^\circ$ and the phase of the current is $+90^\circ$. Since the current phase is greater, the current leads the voltage by $90^\circ - 30^\circ = 60^\circ$.

Q41.

Answer: C

Explanation:

From $P = V_{rms} I_{rms} \cos \phi$, we get

$$V_{rms} = \frac{P}{I_{rms} \cos \phi} = \frac{100}{2 \times 0.5} = 100 \text{ V. The peak voltage is}$$

$$V_0 = \sqrt{2} \times V_{rms} = 1.414 \times 100 \approx 141 \text{ V.}$$

Q42.

Answer: B

Explanation:

The peak current is $I_0 = \frac{E_0}{R} = \frac{200}{40} = 5 \text{ A}$. Since the device allows current in only one direction (half-wave), the current flows only during half the cycle, so the mean square current is $\frac{I_0^2}{4}$ and the rms current is $I_{rms} = \frac{I_0}{2} = \frac{5}{2} = 2.5 \text{ A}$.

Q43.

Answer: C

Explanation:

Comparing $V = 200 \sin(200\pi t)$ with $V = V_0 \sin(\omega t)$ gives

$$\omega = 200\pi \text{ rad/s. Hence the frequency is } f = \frac{\omega}{2\pi} = \frac{200\pi}{2\pi} = 100$$

$$\text{Hz and the time period is } T = \frac{1}{f} = \frac{1}{100} = 0.01 \text{ s.}$$

Q44.

Answer: C

Explanation:

The rms voltage is $E_{rms} = \frac{100\sqrt{2}}{\sqrt{2}} = 100 \text{ V}$. The capacitive

reactance is $X_C = \frac{1}{\omega C} = \frac{1}{200 \times 2 \times 10^{-6}} = 2500 \Omega$, so the ammeter

$$\text{reads } I_{rms} = \frac{E_{rms}}{X_C} = \frac{100}{2500} = 0.04 \text{ A} = 40 \text{ mA.}$$

Q45.

Answer: B

Explanation:

For full intensity, the bulb current is $I = \frac{P}{V_R} = \frac{16}{80} = 0.2 \text{ A}$ and the bulb voltage is 80 V. The coil takes the remaining voltage:

$$V_L = \sqrt{V^2 - V_R^2} = \sqrt{100^2 - 80^2} = 60 \text{ V. Hence}$$

$$X_L = \frac{V_L}{I} = \frac{60}{0.2} = 300 \Omega, \text{ and } L = \frac{X_L}{2\pi f} = \frac{300}{100\pi} = \frac{3}{\pi} \approx 0.95 \text{ H.}$$

Q46.

Answer: C

Explanation:

Williamson synthesis is a well-known laboratory method for the preparation of ethers. It involves the nucleophilic substitution of an alkyl halide (such as ethyl chloride) by an alkoxide ion (such as sodium tert-butoxide). In this reaction, the alkoxide attacks the alkyl halide, displacing the halide ion and forming an ether bond.

Q47.

Answer: A

Explanation:

In the first step, prop-1-ene (or but-1-ene) undergoes anti-Markownikoff addition with HBr in the presence of peroxide (H_2O_2), yielding a primary alkyl bromide (Y) as the major product. In the second step, this primary alkyl halide reacts with sodium ethoxide (C_2H_5ONa) via a Williamson ether synthesis mechanism to form an unsymmetrical ether (Z).

Q48.

Answer: C

Explanation:

Periodic acid (HIO_4) is a powerful oxidizing agent that specifically cleaves 1,2-diols (vicinal diols) across the carbon-carbon bond. When ethylene glycol ($HOCH_2-CH_2OH$) reacts with periodic acid, the C-C bond between the two hydroxyl-bearing carbon atoms is cleaved, resulting in the formation of two molecules of formaldehyde ($2H_2C = O$).

Q49.

Answer: B

Explanation:

Phenol (C_6H_5OH) is significantly more acidic than aliphatic alcohols and benzyl alcohol because the phenoxide ion formed after the loss of a proton is stabilized by resonance through the aromatic ring. In contrast, benzyl alcohol has a saturated methylene ($-CH_2-$) group separating the benzene ring from the oxygen atom, which prevents direct resonance stabilization of the negative charge on oxygen.

Q50.

Answer: D

Explanation:

Active metals like sodium (Na) react with compounds containing active (acidic) hydrogen atoms attached to electronegative atoms (such as oxygen in $-OH$ or $-COOH$ groups) to liberate hydrogen gas (H_2). Ethers do not contain active hydrogen and therefore do not react with sodium metal.

Q51.

Answer: A

Explanation:

Acid-catalyzed dehydration of alcohols proceeds via the formation of a carbocation intermediate. The presence of an electron-withdrawing group (like $-NO_2$) destabilizes the carbocation if it is too close to the positive charge (due to -I effect). However, the ease of dehydration depends on the stability of the carbocation formed, which is facilitated when the carbocation can be formed with minimum destabilization or at a more substituted position. Looking at the structural options, structure (a) forms a carbocation that can eliminate water readily to form a conjugated or stable alkene.

Q52.

Answer: A

Explanation:

The reaction represents the industrial preparation of phenol and acetone via the auto-oxidation of cumene (isopropylbenzene). Cumene reacts with atmospheric oxygen to form cumene hydroperoxide as the stable intermediate A, which upon acid hydrolysis yields phenol and acetone.

Q53.

Answer: B

Explanation:

Dehydration of butan-2-ol via an $E1$ mechanism forms 2-butene as the major product (A) due to Saytzeff's rule. Subsequent addition of HBr to 2-butene proceeds via an electrophilic addition mechanism following Markovnikov's rule, yielding 2-bromobutane as the major product (C).

Q54.

Answer: C

Explanation:

The acidity of substituted phenols depends on the nature of the substituent groups attached to the benzene ring. Electron-withdrawing groups (such as $-\text{NO}_2$) stabilize the phenoxide ion by dispersing the negative charge through $-M$ (mesomeric) and $-I$ (inductive) effects, thereby increasing acidity. Electron-donating groups (such as $-\text{CH}_3$) decrease acidity by intensifying the negative charge. Since 2,4,6-trinitrophenol contains three strong electron-withdrawing nitro groups at the ortho and para positions, it exhibits the highest stability of the phenoxide ion, making it the most acidic compound among the choices.

Q55.

Answer: A

Explanation:

Lucas reagent is a solution of anhydrous zinc chloride (ZnCl_2) in concentrated hydrochloric acid (HCl). It is used to classify alcohols (primary, secondary, and tertiary) based on the rate of their reaction (alkyl chloride formation).

Q56.

Answer: A

Explanation:

The acidity of substituted phenols depends on the electronic effects of the substituent groups attached to the benzene ring. Electron-withdrawing groups (such as $-\text{NO}_2$) stabilize the phenoxide ion through $-M$ and $-I$ effects, thereby increasing acidity. Conversely, electron-donating groups (such as $-\text{CH}_3$) destabilize the phenoxide ion via $+I$ and hyperconjugation effects, decreasing acidity. Para-nitrophenol experiences a strong $-M$ effect from the nitro group, making it more acidic than meta-nitrophenol (where only the $-I$ effect operates significantly). Phenol is more acidic than methyl phenol (cresol) because the methyl group is electron-donating. Thus, the overall acidity order is $(iv) > (iii) > (i) > (ii)$.

Q57.

Answer: D

Explanation:

When benzonitrile ($\text{C}_6\text{H}_5\text{CN}$) is treated with lithium aluminum hydride (LiAlH_4) followed by hydrolysis, it undergoes reduction to form benzylamine ($\text{C}_6\text{H}_5\text{CH}_2\text{NH}_2$). Subsequent treatment with nitrous acid ($\text{NaNO}_2 + \text{HCl}$) at low temperature converts the aliphatic-like primary amine group into a diazonium salt, which is unstable and immediately hydrolyzes in the presence of water (H_2O) to yield benzyl alcohol ($\text{C}_6\text{H}_5\text{CH}_2\text{OH}$).

Q58.

Answer: C

Explanation:

Compounds that contain a $\text{CH}_3\text{CH}(\text{OH})-$ group or a $\text{CH}_3\text{CO}-$ group undergo the iodoform test to yield a yellow precipitate of iodoform (CHI_3) when heated with iodine and an alkali (I_2/NaOH). Methanol (CH_3OH) lacks this required structural feature and therefore does not give a positive iodoform test.

Q59.

Answer: A

Explanation:

When an aryl alkyl ether like anisole ($\text{C}_6\text{H}_5\text{OCH}_3$) reacts with hydrogen iodide (HI), protonation of the ether oxygen yields an oxonium ion. Because the phenyl carbon-oxygen bond exhibits partial double-bond character due to resonance and is much stronger than an alkyl carbon-oxygen bond, nucleophilic attack by iodide selectively targets the less sterically hindered methyl group. This cleavage yields iodomethane (CH_3I) and phenol ($\text{C}_6\text{H}_5\text{OH}$).

Q60.

Answer: A

Explanation:

Protonation involves the addition of a proton (H^+) to the lone pair of electrons on the oxygen atom. The ease of protonation depends on the electron density available on the oxygen atom: lower electron density makes it more difficult to protonate. In phenol ($\text{Ph}-\text{O}-\text{H}$), the lone pairs of oxygen are delocalized into the benzene ring via resonance, decreasing electron density on oxygen and making it the weakest base and the most difficult to protonate among the given options.

Q61.

Answer: B

Explanation:

Sodium borohydride (NaBH_4) is a relatively mild reducing agent compared to lithium aluminum hydride (LiAlH_4). It readily reduces ketones and aldehydes to secondary and primary alcohols, respectively, but it is typically not reactive enough to reduce relatively unreactive carboxylic acid derivatives like esters under standard conditions. Therefore, only the ketone group undergoes reduction.

Q62.

Answer: C

Explanation:

Statement I is correct because the Lucas test uses anhydrous zinc chloride and concentrated hydrochloric acid to distinguish between alcohol classes based on their reaction rates. Statement II is incorrect because tertiary alcohols—not primary alcohols—are the most reactive and produce turbidity immediately, whereas primary alcohols do not react significantly at room temperature.

Q63.

Answer: D

Explanation:

When 3-methylbutan-2-ol reacts with HBr , protonation of the hydroxyl group occurs, followed by the departure of a water molecule to form a secondary carbocation. This secondary carbocation undergoes a 1,2-hydride shift to form a more stable tertiary carbocation. Finally, the bromide ion attacks the tertiary carbocation to yield 2-bromo-2-methylbutane as the major product.

Q64.

Answer: B

Explanation:

Benzyl phenyl ether undergoes cleavage with hydrogen iodide (HI) under heating conditions. Because the benzyl group can stabilize a carbocation intermediate (or via an $\text{S}_{\text{N}}2$ mechanism facilitated by the benzyl group), the cleavage yields benzyl iodide and phenol.

Q65.

Answer: B

Explanation:

The acidity of substituted phenols depends on the electronic effects of the substituent groups attached to the benzene ring. Electron-withdrawing groups (like $-NO_2$) stabilize the phenoxide ion by dispersing the negative charge, thereby increasing acidity. Conversely, electron-donating groups (like $-CH_3$) intensify the negative charge and decrease acidity.

Q66.

Answer: C

Explanation:

The yellow precipitate with a characteristic smell is iodoform (CHI_3), indicating that compound *A* undergoes the iodoform test. This requires either a CH_3-CO- group or a secondary alcohol with a $CH_3-CH(OH)-$ group. Given the molecular formula $C_8H_{10}O$, option (c) represents 1-phenylethanol, which has the correct structure to yield iodoform with NaOI (formed from I_2 and NaOH).

Q67.

Answer: A

Explanation:

When ethers react with hot concentrated HI, cleavage typically occurs via an S_N1 or S_N2 mechanism depending on the alkyl groups. For an ether containing a tertiary alkyl group and a methyl group ($CH_3-C(CH_3)_2-O-CH_3$), protonation followed by the departure of the stable tertiary carbocation yields tert-butyl iodide, while the methyl group is converted into methyl alcohol (CH_3OH).

Q68.

Answer: D

Explanation:

The reaction of an alkene with diborane (B_2H_6) followed by oxidation with alkaline hydrogen peroxide (H_2O_2/OH^-) is known as hydroboration-oxidation. This reaction proceeds via anti-Markovnikov's addition of water across the double bond, yielding a primary alcohol when reacted with a terminal alkene.

Q69.

Answer: D

Explanation:

This reaction is the classic Reimer-Tiemann reaction, which involves the conversion of phenol to salicylaldehyde. The active electrophile that attacks the phenol ring is a neutral, electron-deficient species called dichlorocarbene ($:CCl_2$), generated in situ from the reaction of chloroform with a strong base (NaOH).

Q70.

Answer: D

Explanation:

When benzene reacts with 1-chloropropane in the presence of anhydrous $AlCl_3$, Friedel-Crafts alkylation occurs accompanied by carbocation rearrangement. The primary propyl carbocation rearranges to a more stable secondary isopropyl carbocation, yielding cumene (isopropylbenzene) as product *P*. Oxidation of cumene with O_2 followed by acid hydrolysis yields phenol (*Q*) and acetone (*R*).

Q71.

Answer: A

Explanation:

When an unsymmetrical ether containing a primary alkyl group and a tertiary alkyl group reacts with an excess of hydrogen iodide (HI), the reaction proceeds via an S_N1 mechanism for the tertiary group to form a stable tertiary carbocation, which subsequently yields a tertiary iodide. The primary alkyl group undergoes S_N2 attack to form a primary alkyl iodide. With excess HI, both cleavage products convert into their respective iodides.

Q72.

Answer: C

Explanation:

The given chemical sequence involves the conversion of an alcohol into a sodium alkoxide using a strong base (NaH), followed by a nucleophilic substitution reaction (S_N2) of the alkoxide ion with an alkyl halide (Me-I) to yield an ether. This classic laboratory method for synthesizing symmetrical and unsymmetrical ethers is known as the Williamson ether synthesis.

Q73.

Answer: C

Explanation:

The conversion of propene into 1-propanol requires an anti-Markovnikov hydration of the double bond. Hydroboration-oxidation, using diborane (B_2H_6) followed by alkaline hydrogen peroxide (H_2O_2/OH^-), adds water across the unsymmetrical alkene in an anti-Markovnikov manner with syn-stereochemistry to yield the primary alcohol (1-propanol) as the major product.

Q74.

Answer: A

Explanation:

Alkanols (alcohols) are derivatives of alkanes in which one hydrogen atom is replaced by a hydroxyl group ($-OH$). Since the general formula for saturated open-chain alkanes is C_nH_{2n+2} , replacing one hydrogen atom with an $-OH$ group gives the general molecular formula for alkanols as $C_nH_{2n+2}O$ (or $C_nH_{2n+1}OH$).

Q75.

Answer: B

Explanation:

Anisole (methoxybenzene) is an aromatic ether formed by the Williamson synthesis. Treating phenol (C_6H_5OH) with sodium hydroxide (NaOH) forms sodium phenoxide, which then undergoes a nucleophilic substitution (S_N2) reaction with iodomethane (CH_3I) to yield anisole and sodium iodide.

Q76.

Answer: B

Explanation:

When phenol is heated with zinc dust, it undergoes reduction to form benzene (*X*). Benzene then undergoes Friedel-Crafts alkylation with chloromethane in the presence of anhydrous aluminium chloride to form toluene (*Y*). Finally, catalytic oxidation of toluene using alkaline potassium permanganate ($KMnO_4$) oxidizes the side chain, yielding benzoic acid (*Z*).

Q77.

Answer: A

Explanation:

Ethylene oxide (C_2H_4O) is a cyclic ether (oxirane) containing a strained three-membered ring. When treated with a Grignard reagent ($RMgX$), the nucleophilic alkyl group attacks one of the carbon atoms, causing ring opening. Subsequent hydrolysis yields a primary alcohol containing two more carbon atoms than the original Grignard reagent.

Q78.

Answer: A

Explanation:

The acidic strength of a compound depends on the stability of its conjugate base. Carboxylic acids are stronger acids than phenols due to better resonance stabilization of the carboxylate ion. Among phenols, the presence of strongly electron-withdrawing nitro groups ($-NO_2$) enhances acidity significantly, making 2,4,6-trinitrophenol (picric acid) stronger than carboxylic acids. Phenol is more acidic than cyclohexanol because the phenoxide ion is resonance stabilized, whereas cyclohexanol yields an aliphatic alkoxide ion.

Q79.

Answer: D

Explanation:

Industrially, methanol is manufactured by the catalytic hydrogenation of carbon monoxide. A mixture of carbon monoxide and hydrogen (known as synthesis gas or water gas) is passed over a heated catalyst composed of zinc oxide and chromium oxide ($ZnO - Cr_2O_3$) under high pressure.

Q80.

Answer: D

Explanation:

Williamson's synthesis is a standard laboratory method for the preparation of symmetrical and unsymmetrical ethers. It involves the reaction of an alkyl halide with a sodium alkoxide. When ethyl chloride (C_2H_5Cl) is treated with sodium ethoxide (C_2H_5ONa), it undergoes a bimolecular nucleophilic substitution (S_N2) reaction to yield diethyl ether ($C_2H_5OC_2H_5$).

Q81.

Answer: A

Explanation:

Diethyl ether ($C_2H_5OC_2H_5$) does not contain any electron-withdrawing carbonyl group ($C=O$) or polar unsaturated group that can act as an electrophilic center. As a result, it is completely resistant to nucleophilic attack by hydroxyl ions (OH^-). In contrast, carbonyl-containing compounds like esters, amides, and nitriles possess electrophilic carbon atoms that readily undergo nucleophilic addition or substitution.

Q82.

Answer: C

Explanation:

When the vapours of a secondary alcohol are passed over heated copper (Cu) at 573 K, it undergoes a catalytic dehydrogenation reaction. Since secondary alcohols contain two alkyl groups attached to the carbinol carbon, the removal of one hydrogen atom from the hydroxyl group ($-OH$) and one hydrogen atom from the carbon atom yields a ketone as the main product. (Primary alcohols give aldehydes under these conditions, while tertiary alcohols undergo dehydration to form alkenes).

Q83.

Answer: A

Explanation:

Ethanol contains a hydroxyl group ($-OH$) attached directly to a carbon atom, which allows its molecules to form strong intermolecular hydrogen bonds. Dimethyl ether contains an oxygen atom bonded to two methyl groups ($C-O-C$), which does not have hydrogen atoms bonded to oxygen and therefore cannot form hydrogen bonds with itself. This results in significantly stronger intermolecular forces in ethanol, giving it a higher boiling point.

Q84.

Answer: D

Explanation:

The acidic strength of substituted phenols depends on the nature of the substituent group attached at the para position. Electron-withdrawing groups increase acidity by stabilizing the phenoxide ion through $-M$ and $-I$ effects, whereas electron-donating groups decrease acidity by destabilizing the phenoxide ion through $+M$ or $+I$ effects. The nitro group ($-NO_2$) is strongly electron-withdrawing, the methyl group ($-CH_3$) is weakly electron-donating via hyperconjugation/inductive effect, and the methoxy group ($-OCH_3$) has a strong $+M$ electron-donating effect. Therefore, the increasing order of acid strength is p -methoxyphenol $<$ p -methylphenol $<$ p -nitrophenol.

Q85.

Answer: C

Explanation:

When glycerol ($CH_2OH - CHOH - CH_2OH$) is treated with an excess of hydrogen iodide (HI), it first forms glycerol triiodide ($CH_2I - CHI - CH_2I$), which is unstable. It immediately loses a molecule of iodine (I_2) to form allyl iodide ($CH_2 = CH - CH_2I$). In the presence of excess HI , allyl iodide reacts further to yield isopropyl iodide (2-iodopropane), which upon treatment with HI or during elimination processes yields propene as the final stable product under these conditions.

Q86.

Answer: C

Explanation:

Ethanol reacts with PBr_3 to form bromoethane (X). Elimination of HBr using alcoholic KOH gives ethene (Y). Subsequent hydration of ethene via cold concentrated H_2SO_4 followed by reaction with water and heat re-forms ethanol (Z).

Q87.

Answer: D

Explanation:

When acetone (propan-2-one) reacts with ethylmagnesium bromide (a Grignard reagent, C_2H_5MgBr) in the presence of dry ether, a nucleophilic addition reaction takes place at the carbonyl carbon. Subsequent acid hydrolysis yields a tertiary alcohol with a 5-carbon principal chain containing a methyl substituent at carbon-2, which is 2-methyl butan-2-ol.

Q88.

Answer: C

Explanation:

Primary alcohols (such as n -propyl alcohol) and secondary alcohols (such as isopropyl alcohol) behave differently upon oxidation. Oxidation of a primary alcohol yields an aldehyde with the same number of carbon atoms, which can be further oxidized to a carboxylic acid, whereas oxidation of a secondary alcohol yields a ketone. Alternatively, specific reagents like the Lucas test or catalytic dehydrogenation can differentiate them, but among the given choices, controlled oxidation is the standard chemical method.

Q89.

Answer: A

Explanation:

When vapours of a primary alcohol are passed over a heated copper or silver catalyst at 573 K, dehydrogenation takes place (removal of hydrogen), resulting in the formation of an aldehyde with the same number of carbon atoms.

Q90.

Answer: A

Explanation:

A primary alcohol is characterized by having the hydroxyl group ($-OH$) attached to a primary carbon atom ($-CH_2 - OH$). By drawing all possible structural isomers of pentyl alcohol ($C_5H_{11}OH$) that feature a $-CH_2 - OH$ group, we find a total of 5 primary alcohol isomers.

Q91.

Answer: C

Q92.

Answer: B

Q93.

Answer: B

Q94.

Answer: D

Q95.

Answer: C

Q96.

Answer: B

Q97.

Answer: A

Q98.

Answer: C

Q99.

Answer: B

Q100.

Answer: B

Q101.

Answer: D

Q102.

Answer: B

Q103.

Answer: C

Q104.

Answer: B

Q105.

Answer: B

Q106.

Answer: B

Q107.

Answer: B

Q108.

Answer: A

Q109.

Answer: A

Q110.

Answer: B

Q111.

Answer: B

Q112.

Answer: A

Q113.

Answer: D

Q114.

Answer: C

Q115.

Answer: B

Q116.

Answer: A

Q117.

Answer: B

Q118.

Answer: B

Q119.

Answer: C

Q120.

Answer: C

Q121.

Answer: B

Q122.

Answer: C

Q123.

Answer: A

Q124.

Answer: D

Q125.

Answer: A

Q126.

Answer: B

Q127.

Answer: A

Q128.

Answer: A

Q129.

Answer: B

Q130.

Answer: B

Q131.

Answer: D

Q132.

Answer: B

Q133.

Answer: A

Q134.

Answer: C

Q135.

Answer: C

Q136.

Answer: A

Q137.

Answer: A

Q138.

Answer: B

Q139.

Answer: B

Q140.

Answer: A

Q141.

Answer: B

Q142.

Answer: B

Q143.

Answer: B

Q144.

Answer: B

Q145.

Answer: A

Q146.

Answer: D

Q147.

Answer: B

Q148.

Answer: B

Q149.

Answer: A

Q150.

Answer: A

Q151.

Answer: A

Q152.

Answer: A

Q153.

Answer: A

Q154.

Answer: B

Q155.

Answer: A

Q156.

Answer: A

Q157.

Answer: A

Q158.

Answer: A

Q159.

Answer: A

Q160.

Answer: A

Q161.

Answer: B

Q162.

Answer: C

Q163.

Answer: B

Q164.

Answer: B

Q165.

Answer: A

Q166.

Answer: A

Q167.

Answer: A

Q168.

Answer: A

Q169.

Answer: A

Q170.

Answer: D

Q171.

Answer: C

Q172.

Answer: B

Q173.

Answer: A

Q174.

Answer: D

Q175.

Answer: B

Q176.

Answer: A

Q177.

Answer: B

Q178.

Answer: B

Q179.

Answer: A

Q180.

Answer: A