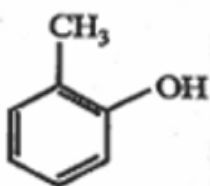


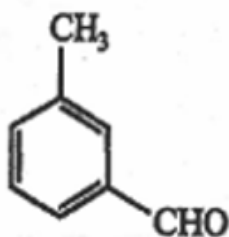
Chemistry

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

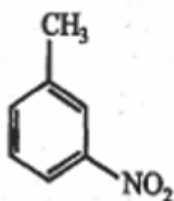
A)



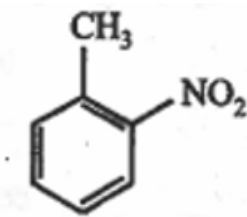
B)



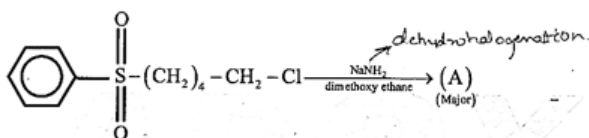
C)



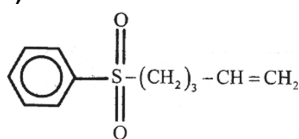
D)



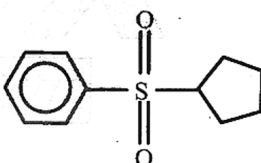
2. Product A is



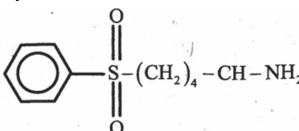
A)



B)

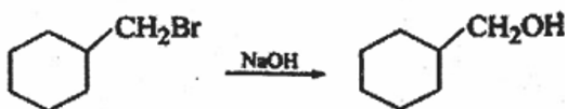


C)



D) None of these

3. Suggest the suitable solvent for the reaction given below



A) H₂O

B) HCONMe₂

C) C₆H₆

D) C₆H₅OH

4. Pick up a correct statement from the following:

A) Isobutene undergoes chlorination with Cl₂ in presence of UV light to give 1-chloro-2-methylpropane.

B) 2-Methylbut-1-ene reacts with HCl to give 2-chloro-2-methylbutane

C) Propene undergoes chlorination with Cl₂ in CCl₄ to give n-propyl chloride.

D) 2-Methylbut-2-ene reacts with HI to give 2-iodo-3-methylbutane

5. Which of the following compounds has the highest boiling point?

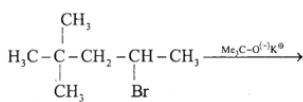
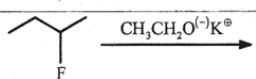
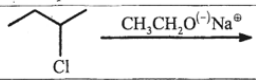
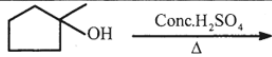
A) CH₃CH(CH₃)CH₂Cl

B) CH₃CH₂CH₂CH₂Cl

C) (CH₃)₃CCl

D) CH₃CH₂CH₂Cl

6. Match the following column

	Column I		Column II
A)		(p)	Saytzeff's product
B)		(q)	Carbocation
C)		(r)	E2 elimination
D)		(s)	Hoffman product

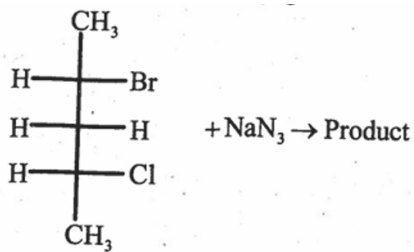
A) A-r, s; B-r, s; C-p, r; D-p, q

B) A-p, s; B-r, s; C-q, r; D-r, s

C) A-p, r; B-r, s; C-q, s; D-p, q

D) A-p, s; B-q, s; C-p, r; D-r, s

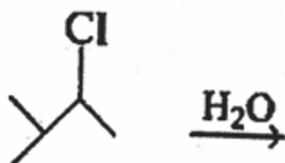
7. What is the principal product of the following



reaction?

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

8. Find the product of the following reaction:



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

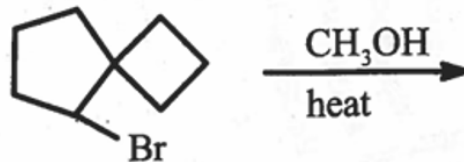
9. On complete hydrogenation, natural rubber produces

- A) ethylene - propylene copolymer
B) vulcanised rubber
C) polypropylene
D) polybutylene

10. Which one of the following sets forms the biodegradable polymer?

- A) $HO-CH_2-CH_2-OH$ & $HOOC-C_6H_4-COOH$
B) $CH=CH_2$ and $CH_2=CH-CH=CH_2$
C) $CH_2=CH-CN$ and $CH_2=CH-COOH$
D) $CH_2=CH-CN$ and $CH_2=CH-COOH$

11.

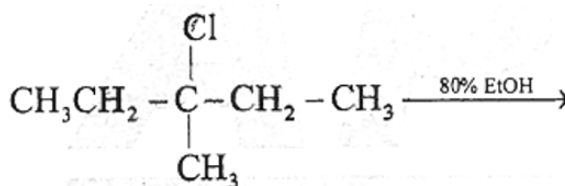


Product, which of the following products are possible.



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

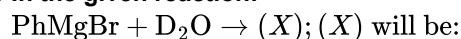
12.



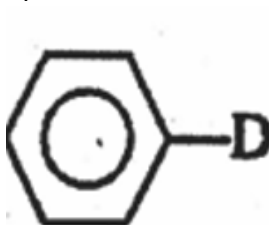
What is / are true about above reaction? I) Major product is given by S_N1 reaction II) Through E₁ mechanism 3 alkenes are formed III) 3-Methylpentan-3-ol is also formed as one of the products IV) Fractional distillation of elimination product will give two fractions

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

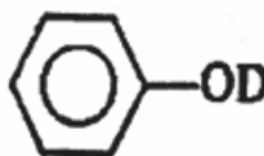
13. In the given reaction:



A)

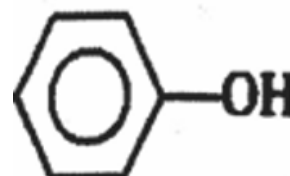


C)



B)

D)



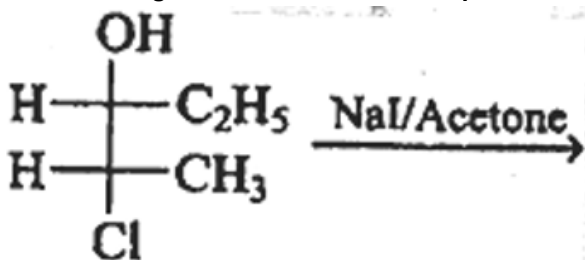
14. Which one of the following statements is FALSE?

- A) The decreased reactivity of haloarenes is due to their low polarity.
 B) C-X bond cleavage in aryl halides is difficult due to +R effect.
 C) The percentage of s-character in haloarenes is more when compared to that in haloalkanes.
 D) Haloarenes are electron rich and hence they readily allow substitution of halide group by a hydroxy group.

15. Select the correct order of decreasing reactivity of the following compounds towards the attack of Grignard reagent. I. Methyl benzoate II. Benzaldehyde III. Benzoylchloride IV. Acetophenone

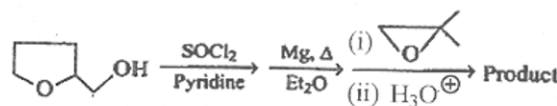
- A) I > II > III > IV
 B) II > III > I > IV
 C) II > IV > I > III
 D) III > II > IV > I

16. In the following reaction find the correct product:



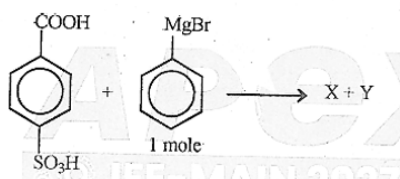
- A)
- B)
- C)
- D)

17. Product of reaction is:



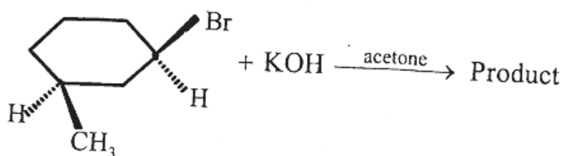
- A)
- B)
- C)
- D)

18. X and Y are respectively:



- A)
- B)
- C) None of these
- D)

19.



(1R, 3S)-Cis-1-Bromo-3-methylcyclohexane

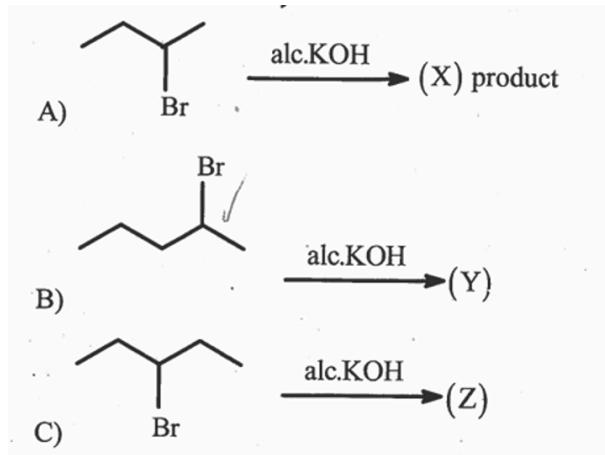
+KOH $\xrightarrow{\text{acetone}}$ Product The product formed in the reaction is

- A) (1R,3S)-Cis-3-methyl cyclohexanol
 B) (1S,3S)-Cis-3-methyl cyclohexanol
 C) (1S,3S)-Trans-3-methyl cyclohexanol
 D) (1R,3R)-Trans-3-methyl cyclohexanol

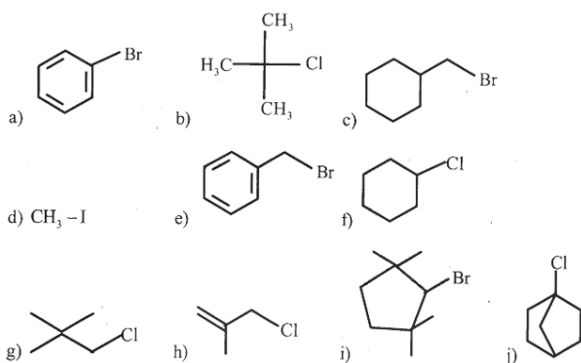
20. What is the common name of 3-Bromopropene?

- A) Allyl bromide B) Propylidene bromide
C) Vinyl bromide D) Tert-Butyl bromide

21. Sum of $X + Y + Z =$



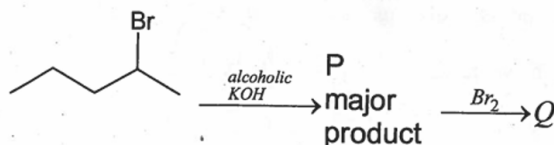
22. Examine the given ten structures shown below and select those that satisfy each of the following condition and sum of $X + Y + Z =$



X $\rightarrow$ How many compounds give S_N2 reaction on treatment with NaSH ? Y $\rightarrow$ How many compounds give E_2 reaction on treatment with alcoholic KOH ? Z $\rightarrow$ How many compounds do not react under either of the previous reaction conditions?

23. Consider all the structural isomers with molecular formula $\text{C}_5\text{H}_{11}\text{Br}$ are separately treated with KOH (aq) to give respective substitution products, without any rearrangement. The number of products which can exhibit optical isomerism from these is _____.

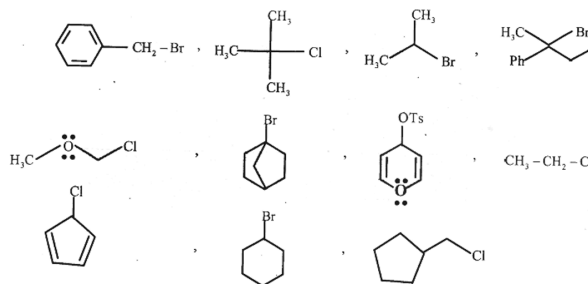
24.



Consider the above sequence of reactions. 151 g of 2-bromopentane is made to react. Yield of major product P is 80% whereas Q is 100%. Mass of product Q obtained is _____ g.

(Given molar mass in g mol^{-1} H: 1, C: 12, O: 16, Br: 80)

25. Identify number of substrates those can give S_N1 and S_N2 reaction both.



Maths

26. The length of the latus-rectum of the parabola $169 \{(x-1)^2 + (y-3)^2\} = (5x-12y+17)^2$ is:

- A) $\frac{12}{13}$ B) $\frac{14}{13}$
C) $\frac{28}{13}$ D) $\frac{31}{13}$

27. The equation of directrix of the parabola

$$x^2 + 4y - 6x + k = 0 \text{ is } y + 1 = 0, \text{ then:}$$

- A) $k = 7$ B) $k = -17$
C) Focus is $(3, -3)$ D) Vertex is $(3, -3)$

28. The ends of the latus rectum of the conic

$$x^2 + 10x - 16y + 25 = 0 \text{ are:}$$

- A) $(3, -4), (13, 4)$ B) $(-3, -4), (13, -4)$
C) $(3, 4), (-13, 4)$ D) $(5, -8), (-5, 8)$

29. Coordinates of any point on the parabola, whose focus is $(-\frac{3}{2}, -3)$ and the directrix is $2x + 5 = 0$ is given by:

- A) $(2t^2 + 2, 2t - 3)$ B) $(2t^2 - 2, 2t - 3)$
C) $(2t^2 - 2, 2t + 3)$ D) $(2t^2 + 2, 2t + 3)$

30. If the focus of a parabola is $(-2, 1)$ and the directrix has the equation $x + y = 3$, then the vertex is:

- A) $(0, 3)$ B) $(-1, \frac{1}{2})$
C) $(-1, 2)$ D) $(2, -1)$

31. The co-ordinates of a point on the parabola

$$y^2 = 8x \text{ whose focal distance is 4 is:}$$

- A) $(2, 4)$ B) $(4, 2)$
C) $(2, -6)$ D) $(4, -2)$

32. Co-ordinate of the focus of the parabola

$$x^2 - 4x - 8y - 4 = 0 \text{ are:}$$

- A) $(0, 2)$ B) $(2, 1)$
C) $(-3, -\frac{71}{10})$ D) $(2, -1)$

33. Axis of a parabola is $y = x$ and vertex and focus are at a distance $\sqrt{2}$ and $2\sqrt{2}$ respectively from the origin. Then, equation of the parabola is:

- A) $(x - y)^2 = 8(x + y - 2)$ B) $(x + y)^2 = 2(x + y - 2)$
 C) $(x - y)^2 = 4(x + y - 2)$ D) $(x + y)^2 = 2(x - y + 2)$

34. Let P be the parabola, whose focus is $(-2, 1)$ and directrix is $2x + y + 2 = 0$. Then the sum of the ordinates of the points on P , whose abscissa is -2 , is:

- A) $\frac{5}{2}$ B) $\frac{3}{2}$
 C) $\frac{3}{4}$ D) $\frac{1}{4}$

35. If the equation of the parabola, whose vertex is at $(5, 4)$ and the directrix is $3x + y - 29 = 0$, is $x^2 + ay^2 + bxy + cx + dy + k = 0$, then $a + b + c + d + k$ is equal to:

- A) 575 B) -575
 C) 576 D) -576

36. If vertex of a parabola is $(2, -1)$ and the equation of its directrix is $4x - 3y = 21$, then the length of its latus rectum is:

- A) 2 B) 8
 C) 12 D) 16

37. A parabola has the origin as its focus and the line $x = 2$ as the directrix. Then the vertex of the parabola is at:

- A) $(0, 2)$ B) $(1, 0)$
 C) $(0, 1)$ D) $(2, 0)$

38. The area (in sq. units) of an equilateral triangle inscribed in the parabola $y^2 = 8x$, with one of its vertices on the vertex of this parabola, is:

- A) $256\sqrt{3}$ B) $64\sqrt{3}$
 C) $128\sqrt{3}$ D) $192\sqrt{3}$

39. Let P be a point on the parabola, $y^2 = 12x$ and N be the foot of the perpendicular drawn from P on the axis of the parabola. A line is now drawn through the mid-point M of PN , parallel to its axis which meets the parabola at Q . If the y -intercept of the line NQ is $\frac{4}{3}$, then:

- A) $MQ = \frac{1}{3}$ B) $PN = 4$
 C) $PN = 3$ D) $MQ = \frac{1}{4}$

40. Let one end of a focal chord of the parabola $y^2 = 16x$ be $(16, 16)$. If $P(\alpha, \beta)$ divides this focal chord internally in the ratio $5 : 2$, then the minimum value of $\alpha + \beta$ is equal to:

- A) 5 B) 7
 C) 22 D) 16

41. If the chord joining the points $P_1(x_1, y_1)$ and $P_2(x_2, y_2)$ on the parabola $y^2 = 12x$ subtends a right angle at the vertex of the parabola, then $x_1x_2 - y_1y_2$ is equal to:

- A) 280 B) 288
 C) 292 D) 284

42. Let the locus of the mid-point of the chord through the origin O of the parabola $y^2 = 4x$ be the curve S . Let P be any point on S . Then the locus of the point, which internally divides OP in the ratio $3 : 1$, is:

- A) $2x^2 = 3y$ B) $2y^2 = 3x$
 C) $3y^2 = 2x$ D) $3x^2 = 2y$

43. If the line $3x - 2y + 12 = 0$ intersects the parabola $4y = 3x^2$ at the points A and B , then at the vertex of the parabola, the line segment AB subtends an angle equal to:

- A) $\frac{\pi}{2} - \tan^{-1}\left(\frac{3}{2}\right)$ B) $\tan^{-1}\left(\frac{9}{7}\right)$
 C) $\tan^{-1}\left(\frac{11}{9}\right)$ D) $\tan^{-1}\left(\frac{4}{5}\right)$

44. Let the point P of the focal chord PQ of the parabola $y^2 = 16x$ be $(1, -4)$. If the focus of the parabola divides the chord PQ in the ratio $m : n$, $\gcd(m, n) = 1$, then $m^2 + n^2$ is equal to:

- A) 17 B) 37
 C) 10 D) 26

45. If one end of a focal chord of the parabola, $y^2 = 16x$ is at $(1, 4)$, then the length of this focal chord is:

- A) 24 B) 20
 C) 25 D) 22

46. A parabola which has directrix $x + y + 2 = 0$ and touches a line $2x + y - 5 = 0$ at $(2, 1)$. If m is the latus rectum of the parabola, then the value of $\frac{m}{\sqrt{2}}$ is:

47. Let the image of parabola $x^2 = 4y$, in the line $x - y = 1$ be $(y + a)^2 = b(x - c)$, $a, b, c \in \mathbb{N}$. Then $a + b + c$ is equal to:

48. If the equation of the parabola with vertex $V\left(\frac{3}{2}, 3\right)$ and the directrix $x + 2y = 0$ is $\alpha x^2 + \beta y^2 - \gamma xy - 30x - 60y + 225 = 0$, then $\alpha + \beta + \gamma$ is equal to:

49. The axis of a parabola is the line $y = x$ and its vertex and focus are in the first quadrant at distances $\sqrt{2}$ and $2\sqrt{2}$ units from the origin, respectively. If the point $(1, k)$ lies on the parabola, then a possible value of k is:

50. Let P_1 be a parabola with vertex $(3, 2)$ and focus $(4, 4)$ and P_2 be its mirror image with respect to the line $x + 2y = 6$. Then the directrix of P_2 is $x + 2y = \underline{\hspace{2cm}}$.

Physics

51. If the frequency of an alternating current is 60 Hz then the time taken for the change from zero to positive peak value and positive peak value to negative peak value of current are respectively

- A) 1/240 sec, 1/120 sec B) 1/120 sec, 1/240 sec
C) 240 sec, 120 sec D) 1/60 sec, 1/120 sec

52. What will be the equation of an alternating current of frequency 60 Hz if its r.m.s. value is 15 A?

- A) $i = 15 \sin 120\pi t$ B) $i = 15\sqrt{2} \sin 120\pi t$
C) $i = \frac{15}{\sqrt{2}} \sin 120\pi t$ D) $i = 15\sqrt{2} \sin 60\pi t$

53. The instantaneous value of alternating voltage in a circuit is given by $V = 5 \sin(200\pi t + \frac{\pi}{6})$ volts. The value of the voltage at the beginning where $t = 0$ will be

- A) 5 V B) $\frac{5}{2}$ V
C) $\frac{5\sqrt{3}}{2}$ V D) $5\sqrt{3}$ V

54. The voltage of an alternating source varies with time according to the equation $V = 60 \sin(150\pi t) \cos(150\pi t)$ where t is in seconds and V is in volts. Then

- A) The peak voltage of the source is 60 volts B) The peak voltage of the source is 30 volts
C) The peak voltage of the source is $60/\sqrt{2}$ volts D) The frequency of the source is 75 Hz

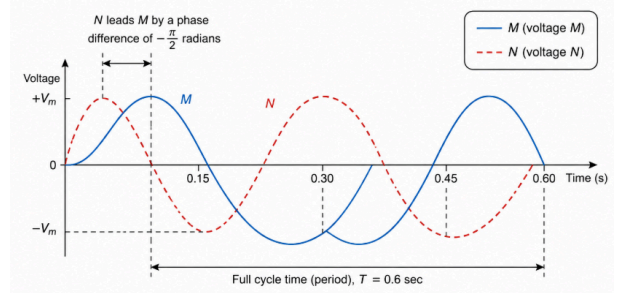
55. Voltage and current in an alternating current circuit are given by $V = 10 \sin(50\pi t + \frac{\pi}{6})$ and $i = 5 \sin(50\pi t - \frac{\pi}{3})$. The phase relationship between them is

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

56. An alternating voltage source given by $E = 200 \sin 100t$ is connected to a device that offers a resistance of 50Ω and allows current to flow in one direction only. The r.m.s. value of current in the circuit will be

- A) 1.00 A B) 1.41 A
C) 2.00 A D) 2.82 A

57. Two sinusoidal alternating voltages of the same frequency are given in a circuit. Voltage M has a time period of 0.6 sec and a phase lag, whereas voltage N leads M by a phase difference of $-\frac{\pi}{2}$ radians, with a full cycle time period of 0.6 sec. What is the frequency and the phase relationship between the voltages?



- A) 1.67 Hz, $-\frac{\pi}{4}$ B) 1.67 Hz, $+\frac{\pi}{2}$
C) 1.67 Hz, $-\frac{\pi}{2}$ D) 1.67 Hz, $-\frac{\pi}{4}$

58. In a resistive circuit $R = 20 \Omega$ and applied alternating voltage $V = 200 \sin 200 \pi t$, find the peak current, r.m.s. current, average current, and frequency respectively

- A) 10 A, $5\sqrt{2}$ A, 6.37 A, 50 Hz B) 10 A, 10 A, 6.37 A, 100 Hz
C) $10\sqrt{2}$ A, 10 A, 5 A, 50 Hz D) 10 A, $5\sqrt{2}$ A, 6.37 A, 100 Hz

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

- A) 100 Hz, 40Ω B) 50 Hz, 20Ω
C) 100 Hz, 80Ω D) 50 Hz, 40Ω

60. The current and voltage in an alternating current circuit are given by $i = 2 \sin(314t)$ and $e = 400 \sin(314t + \frac{\pi}{3})$. If the resistance of the circuit is 100Ω , then the inductive reactance of the circuit is

- A) $100\sqrt{3} \Omega$ B) 200Ω
C) $100/\sqrt{3} \Omega$ D) $200\sqrt{3} \Omega$

61. In an alternating current circuit containing a series combination of an inductance of 0.2 H and a capacitance of $50 \mu\text{F}$, the current is found to be maximum. Find the angular frequency of the input alternating voltage.

- A) 200 rad/sec B) 500 rad/sec
C) 1000 rad/sec D) 2000 rad/sec

62. In an ac circuit, containing an inductance and a capacitor in series, the current is found to be maximum when the value of inductance is 2 henry and a capacitance of $2 \mu\text{F}$. The angular frequency of the input ac voltage must be equal to

- A) 250 rad/sec B) 500 rad/sec
C) 1000 rad/sec D) 5000 rad/sec

63. Find out instantaneous current value for

$$I = I_0 \sin(\omega t) \text{ at } t = \frac{T}{6}$$

- A) $\frac{I_0}{2}$ B) $\frac{I_0}{\sqrt{2}}$
C) $\frac{\sqrt{3}I_0}{2}$ D) I_0

64. If an alternating current main supply is given to be 220 V, what would be the average e.m.f. during a complete cycle?

- A) 198 V B) 0 V
C) 311 V D) 155 V

65. Find the RMS value of the current given by

$$I = 3 + 2 \sin\left(\omega t + \frac{\pi}{3}\right)$$

- A) $\sqrt{11}$ B) $\sqrt{13}$
C) $\sqrt{15}$ D) $\sqrt{17}$

66. The current and voltage in an alternating circuit are given by $i = 4.5 \sin\left(314t + \frac{\pi}{6}\right)$ A and $V = 32 \sin\left(314t - \frac{\pi}{6}\right)$ V. Find (a) the time period of the current and (b) the phase difference between the voltage and the current.

- A) $T = 0.02$ s, $\Delta\phi = 30^\circ$ B) $T = 0.02$ s, $\Delta\phi = 60^\circ$
C) $T = 0.01$ s, $\Delta\phi = 60^\circ$ D) $T = 0.01$ s, $\Delta\phi = 30^\circ$

67. Two alternating voltages are given by

$$V_1 = V_0 \sin(\omega t) \text{ and } V_2 = V_0 \sin\left(\omega t + \frac{\pi}{2}\right). \text{ Find the resultant of the two voltages.}$$

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

68. An alternating voltage given by $E = 150 \sin(500t)$ volt is connected across an inductor of $20 \mu\text{H}$, then write down the equation of current.

- A) $7500 \sin\left(500t - \frac{\pi}{2}\right)$ A B) $15000 \sin\left(500t - \frac{\pi}{2}\right)$ A
C) $7500 \sin\left(500t + \frac{\pi}{2}\right)$ A D) $150 \sin\left(500t - \frac{\pi}{2}\right)$ A

69. If the equation of an alternating current is

$$i = 30\sqrt{2} \sin 200\pi t \text{ ampere, then the frequency and the root mean square value of the current are respectively:}$$

- A) 100 Hz, $30\sqrt{2}$ amp B) 50 Hz, 100 amp
C) 100 Hz, 30 amp D) 200 Hz, $30\sqrt{2}$ amp

70. If the equation of an alternating current is given by

$$i = 40\sqrt{2} \sin 100\pi t \text{ ampere, then find the frequency and the root mean square value of the alternating current.}$$

- A) 50 Hz, $40\sqrt{2}$ A B) 100 Hz, 40 A
C) 50 Hz, 40 A D) 200 Hz, $40\sqrt{2}$ A

71. An alternating voltage given by

$$E = 100\sqrt{2} \sin(200t) \text{ V is applied to a } 0.5 \text{ H inductor through an alternating current ammeter. What will be the reading of the ammeter?}$$

72. In an AC circuit containing an inductance and a capacitor in series, the current is found to be maximum when the value of inductance is 0.2 H and the capacitance is $5 \mu\text{F}$. The angular frequency of the input AC voltage must be equal to ___ rad/sec:

73. At what time (from zero) does the alternating current become $1/\sqrt{2}$ times of its peak value? Where T is the periodic time ___ T/x sec, what is the x value.

74. In a circuit, an alternating current and a direct current are supplied simultaneously. The expression for the instantaneous current is given as $i = 4 + 8 \sin(\omega t)$. Then the root mean square value of the current is $4\sqrt{x}$ A? what is the x value

75. An alternating voltage $E = 150\sqrt{2} \sin(100t)$ is connected to a $2 \mu\text{F}$ capacitor through an AC ammeter. What will be the reading of the ammeter? ___ mA

ANSWER KEY

Chemistry

1.	1	8.	3	15.	4	22.	12
2.	2	9.	1	16.	3	23.	3
3.	2	10.	4	17.	1	24.	184
4.	2	11.	4	18.	2	25.	6
5.	2	12.	2	19.	3		
6.	1	13.	1	20.	1		
7.	3	14.	4	21.	8		

Maths

26.	3	33.	1	40.	2	47.	6
27.	3	34.	2	41.	2	48.	9
28.	3	35.	4	42.	2	49.	9
29.	2	36.	2	43.	2	50.	10
30.	3	37.	2	44.	1		
31.	1	38.	4	45.	3		
32.	2	39.	4	46.	9		

Physics

51.	1	58.	4	65.	1	72.	1000
52.	2	59.	1	66.	2	73.	8
53.	2	60.	4	67.	2	74.	3
54.	2	61.	3	68.	2	75.	30
55.	3	62.	2	69.	3		
56.	3	63.	3	70.	3		
57.	3	64.	2	71.	1		

SOLUTIONS

Q1.

Answer: A

Q2.

Answer: B

Q3.

Answer: B

Q4.

Answer: B

Q5.

Answer: B

Q6.

Answer: A

Q7.

Answer: C

Q8.

Answer: C

Q9.

Answer: A

Q10.

Answer: D

Q11.

Answer: D

Q12.

Answer: B

Q13.

Answer: A

Q14.

Answer: D

Q15.

Answer: D

Q16.

Answer: C

Q17.

Answer: A

Q18.

Answer: B

Q19.

Answer: C

Q20.

Answer: A

Q21.

Answer: 8

Q22.

Answer: 12

Q23.

Answer: 3

Q24.

Answer: 184

Q25.

Answer: 6

Q26.

Answer: C

Explanation:

By rewriting the equation in the standard form

$$(x - x_0)^2 + (y - y_0)^2 = \left(\frac{Ax + By + C}{\sqrt{A^2 + B^2}} \right)^2, \text{ we identify the focus}$$

as $S(1, 3)$ and the directrix as $5x - 12y + 17 = 0$. The distance from the focus to the directrix is $2a$, and the length of the latus-rectum is $4a$.

Q27.

Answer: C

Explanation:

By completing the square, we convert the equation to the standard form $(x - h)^2 = -4a(y - k)$. Matching the directrix equation allows us to find $k = 17$, the vertex $(3, -2)$, and the focus $(3, -3)$.

Q28.

Answer: C

Explanation:

Converting the equation to standard form gives $(x + 5)^2 = 16y$, which yields vertex $(-5, 0)$ and $a = 4$. The focus is $(-5, 4)$, and shifting horizontally by $2a = 8$ gives the ends of the latus rectum.

Q29.

Answer: B

Explanation:

Using $SP^2 = PM^2$, we write the equation of the parabola as $(y + 3)^2 = 2(x + 2)$. Changing the standard parameter t to $2t$ yields the parametric point $(2t^2 - 2, 2t - 3)$.

Q30.

Answer: C

Explanation:

The axis of the parabola is perpendicular to the directrix and passes through the focus. The intersection of the axis with the directrix is $(0, 3)$. The vertex is the midpoint of this intersection point and the focus.

Q31.

Answer: A

Explanation:

The focal distance of any point $P(x, y)$ on $y^2 = 4ax$ is $x + a$. Equating this to 4 allows us to find $x = 2$, which gives $y = \pm 4$.

Q32.

Answer: B

Explanation:

Completing the square gives the standard form $(x - 2)^2 = 8(y + 1)$, from which the vertex is $(2, -1)$ and $a = 2$. The focus is $(2, 1)$.

Q33.

Answer: A

Explanation:

The axis is $y - x = 0$ and the tangent at the vertex is $x + y - 2 = 0$ (since the vertex is at $(1, 1)$). Applying $(d_{\text{axis}})^2 = 4a \cdot d_{\text{tangent}}$ gives the equation of the parabola.

Q34.

Answer: B

Explanation:

We write the general equation of the parabola and then substitute $x = -2$. This results in a quadratic equation in y , and the sum of the ordinates corresponds to the sum of the roots of this quadratic.

Q35.

Answer: D

Explanation:

We find the focus of the parabola $S(2, 3)$ by calculating the intersection of the axis of symmetry and the directrix, then using the midpoint formula with the vertex. Using $SP^2 = PM^2$, we expand the equation of the parabola to find all coefficients.

Q36.

Answer: B

Explanation:

The perpendicular distance from the vertex to the directrix is equal to a . The length of the latus rectum is $4a$.

Q37.

Answer: B

Explanation:

The vertex of any parabola is the midpoint of the perpendicular segment from the focus to the directrix.

Q38.

Answer: D

Explanation:

Using symmetry, the vertex at the origin $O(0, 0)$ has two other vertices $A(2t^2, 4t)$ and $B(2t^2, -4t)$ symmetric about the x -axis. The line OA makes an angle of 30° with the axis of symmetry, allowing us to find t and compute the area.

Q39.

Answer: D

Explanation:

Representing P parametrically, we locate N and the midpoint M . Finding the intersection Q of the horizontal line through M and the parabola, we construct the equation of NQ . Using the given y -intercept, we find the parameter $t = 1/3$, which gives the length of MQ .

Q40.

Answer: B

Explanation:

For $y^2 = 16x$, $a = 4$. The given endpoint $A(16, 16)$ has parameter $t_1 = 2$. The other end B of the focal chord must have parameter $t_2 = -1/2$, giving $B(1, -4)$. We analyze the two ways P can divide AB internally in a 5:2 ratio to find the minimum value of $\alpha + \beta$.

Q41.

Answer: B

Explanation:

For any chord of $y^2 = 4ax$ subtending 90° at the vertex $O(0, 0)$, the parameters satisfy $t_1 t_2 = -4$. Evaluating $x_1 x_2 - y_1 y_2$ in terms of $t_1 t_2$ yields the answer.

Q42.

Answer: B

Explanation:

We first find that the curve S is $y^2 = 2x$. Then we apply the section formula for a point dividing the segment from the origin to a point on S in the ratio 3:1 to find the final locus.

Q43.

Answer: B

Explanation:

Since the vertex is $O(0, 0)$, we homogenize the parabola equation using the line equation to get the joint equation of OA and OB . We then find the angle between these lines.

Q44.

Answer: A

Explanation:

For $y^2 = 16x$, the focus is $S(4, 0)$. Using the focal chord property $t_1 t_2 = -1$, we find the other endpoint $Q(16, 16)$. Then, we apply the section formula to find the ratio in which S divides PQ internally.

Q45.

Answer: C

Explanation:

For $y^2 = 16x$, $a = 4$. The endpoint $(1, 4)$ corresponds to $t_1 = 1/2$. The length of the focal chord is given by $a(t + \frac{1}{t})^2$.

Q46.

Answer: 9

Explanation:

By reflecting the focus across the tangent, we find the reflection point on the directrix. Using the properties of the point of contact and directrix, we find the coordinates of the focus as $S(\frac{11}{2}, \frac{3}{2})$, which gives a latus rectum length of $m = 9\sqrt{2}$.

Q47.

Answer: 6

Explanation:

We can find the image of any point on the parabola $x^2 = 4y$ by reflecting it across the line $x - y = 1$. Substituting the transformed coordinates back into the original parabola equation yields the image parabola in the standard horizontal form, from which we solve for the natural numbers a , b , and c .

Q48.

Answer: 9

Explanation:

First, we find the focus S of the parabola. The axis of symmetry is perpendicular to the directrix $x + 2y = 0$ and passes through the vertex V . The intersection of the axis and the directrix is $Z(0, 0)$. Since V is the midpoint of SZ , we find $S(3, 6)$. We then construct the parabola equation using the definition $SP^2 = PM^2$ to find α , β , and γ .

Q49.

Answer: 9

Explanation:

Using the distances from the origin along the line $y = x$, we find the vertex $V(1, 1)$ and focus $S(2, 2)$. This gives us a directrix of $x + y = 0$. By using $SP^2 = PM^2$, we write the equation of the parabola and substitute $x = 1$ to solve for k .

Q50.

Answer: 10

Explanation:

We find the directrix of P_1 using the midpoint properties of the vertex relative to the focus and directrix. Since the mirror line is parallel to this directrix, we reflect the line to find the directrix of P_2 .

Q51.

Answer: A

Explanation:

The time taken to reach from zero to the positive peak value is one-fourth of the time period ($T/4$), and the time taken for the change from the positive peak to the negative peak is half of the time period ($T/2$). Using the given frequency of 60 Hz, the time period is $T = 1/f = 1/60$ sec. Substituting this gives the respective time intervals.

Q52.

Answer: B

Explanation:

The general equation for an alternating current is given by $i = i_0 \sin(\omega t)$, where i_0 is the peak (maximum) current and ω is the angular frequency. The peak value is calculated by multiplying the r.m.s. value by $\sqrt{2}$, and the angular frequency is given by $\omega = 2\pi\nu$. Substituting the given values yields the correct equation.

Q53.

Answer: B

Explanation:

To find the instantaneous value of the alternating voltage at the beginning, we substitute $t = 0$ into the given voltage equation and evaluate the sine of the phase angle.

Q54.

Answer: B

Explanation:

Using the trigonometric identity $\sin(2\theta) = 2 \sin \theta \cos \theta$, the given equation can be rewritten in the standard form of an alternating voltage, $V = V_0 \sin(\omega t)$, allowing us to directly identify the peak voltage and the frequency of the source.

Q55.

Answer: C

Explanation:

The phase angle of the voltage is $\phi_V = \frac{\pi}{6}$ and the phase angle of the current is $\phi_i = -\frac{\pi}{3}$. The phase difference relative to the current is $\Delta\phi = \phi_V - \phi_i = \frac{\pi}{6} - (-\frac{\pi}{3}) = \frac{\pi}{2}$, which means the voltage leads the current by 90° .

Q56.

Answer: C

Explanation:

Since the device restricts the flow of current to one direction only, it acts as a half-wave rectifier, allowing current to flow only during the positive half-cycle. The r.m.s. value of current for a half-wave rectified alternating current is given by $I_{rms} = \frac{I_0}{2}$, where I_0 is the peak current. By finding the peak voltage from the given equation and dividing by twice the resistance, we can determine the r.m.s. value.

Q57.

Answer: C

Explanation:

The frequency is calculated as the reciprocal of the time period $T = 0.6$ sec, giving $f = \frac{1}{0.6} = 1.67$ Hz. The phase difference between the two sinusoidal waves is identified directly from their relative displacement on the time axis, which corresponds to $-\frac{\pi}{2}$.

Q58.

Answer: D

Explanation:

The peak current is obtained by dividing the peak voltage by resistance ($I_0 = V_0/R$). The r.m.s. current is $I_0/\sqrt{2}$, the average current over a half-cycle is $\frac{2}{\pi} I_0$, and the frequency is determined from the angular frequency $\omega = 200\pi$.

Q59.

Answer: A

Explanation:

The frequency of the alternating current is determined from the angular frequency coefficient in the given voltage equation. The inductive reactance is then calculated using the formula $X_L = 2\pi\nu L$.

Q60.

Answer: D

Explanation:

The total impedance of an AC circuit containing resistance and inductance is determined using the peak values of the voltage and current. By applying the relation between total impedance, resistance, and inductive reactance in an RL series circuit, we can calculate the exact inductive reactance.

Q61.

Answer: C

Explanation:

The current in a series L-C-R or L-C alternating current circuit is maximum at resonance. The angular frequency at resonance is given by the formula $\omega_0 = \frac{1}{\sqrt{LC}}$. Substituting the given values of inductance and capacitance yields the angular frequency.

Q62.

Answer: B

Explanation:

The current in a series LC circuit reaches its maximum value at resonance condition, where the inductive reactance equals the capacitive reactance. The angular frequency at resonance is given by the formula $\omega_0 = \frac{1}{\sqrt{LC}}$.

Q63.

Answer: C

Explanation:

To find the instantaneous current at a given time fraction of the time period, substitute $t = \frac{T}{6}$ into the standard alternating current equation $I = I_0 \sin(\omega t)$ and simplify using the angular frequency relation $\omega = \frac{2\pi}{T}$.

Q64.

Answer: B

Explanation:

The average value of a sinusoidal alternating current or voltage over one complete time period (full cycle) is always zero because the positive half cycle and the negative half cycle completely cancel each other out.

Q65.

Answer: A

Explanation:

To find the root-mean-square (RMS) value of a combined DC and AC current, we compute the square root of the average of the squared instantaneous current over a full cycle. The time average of a squared sine function over a full cycle is one-half, and the time average of a single sine term is zero.

Q66.

Answer: B

Explanation:

The time period of an alternating waveform depends on its angular frequency and is calculated using the relation $T = \frac{2\pi}{\omega}$. The phase difference between the voltage and current is determined by finding the absolute difference between their respective phase angles given in their sinusoidal expressions.

Q67.

Answer: B

Explanation:

The resultant of two sinusoidal voltages of the same frequency and amplitude with a phase difference is found using phasor addition. By applying the parallelogram law of vector addition with a phase angle of ninety degrees, the resultant amplitude becomes $\sqrt{V_0^2 + V_0^2 + 2V_0V_0 \cos(90^\circ)}$, which simplifies to $\sqrt{2}V_0$, and the phase leads by forty-five degrees.

Q68.

Answer: B

Explanation:

In a purely inductive AC circuit, the alternating current lags behind the applied alternating voltage by a phase angle of $\frac{\pi}{2}$ radians. The peak current is calculated by dividing the peak voltage by the inductive reactance $X_L = \omega L$.

Q69.

Answer: C

Explanation:

By comparing the given alternating current equation with the standard equation $i = i_0 \sin \omega t$, we can determine the peak current i_0 and angular frequency ω . From ω , we calculate the frequency $\nu = \frac{\omega}{2\pi}$, and using $i_{\text{rms}} = \frac{i_0}{\sqrt{2}}$, we find the root mean square value of the current.

Q70.

Answer: C

Explanation:

By comparing the given alternating current equation with the standard form $i = i_0 \sin \omega t$, we find the peak current i_0 and the angular frequency ω . The frequency is then calculated using the formula $\nu = \frac{\omega}{2\pi}$, and the root mean square current is obtained using the formula $i_{\text{rms}} = \frac{i_0}{\sqrt{2}}$.

Q71.

Answer: 1

Explanation:

The reading of an alternating current ammeter corresponds to the root mean square value of the current, which is determined by dividing the root mean square value of the applied voltage by the inductive reactance of the circuit.

Q72.

Answer: 1000

Explanation:

In an AC circuit containing an inductor and a capacitor in series, the current is maximum at resonance. The resonant angular frequency is given by the formula $\omega_0 = \frac{1}{\sqrt{LC}}$. Substituting the given values of inductance and capacitance into the formula yields the angular frequency.

Q73.

Answer: 8

Explanation:

The alternating current can be represented as a sine wave starting from zero. To find the time when the current reaches $1/\sqrt{2}$ of its peak value, we substitute this value into the general equation of alternating current and solve for time t in terms of the time period T .

Q74.

Answer: 3

Explanation:

The given current is a combination of a direct current component and an alternating current component. The root mean square value of such a combined current is calculated using the square root of the sum of the square of the direct current value and the square of the root mean square value of the alternating current.

Substituting $I_{dc} = 4 \text{ A}$ and $I_{ac,rms} = \frac{8}{\sqrt{2}} = 4\sqrt{2} \text{ A}$, we get

$$I_{rms} = \sqrt{4^2 + (4\sqrt{2})^2} = 4\sqrt{3} \text{ A}.$$

Q75.

Answer: 30

Explanation:

The alternating ammeter measures the root mean square (r.m.s.) value of the current flowing through the circuit. By identifying the root mean square value of the applied alternating voltage and calculating the capacitive reactance based on the angular frequency and capacitance, we can determine the r.m.s. current using Ohm's law for AC circuits.