

All India Aakash Test Series for JEE (Main)-2020

TEST - 2 - Code-E

Test Date : 17/11/2019

ANSWERS

PHYSICS

1. (1)
2. (3)
3. (4)
4. (1)
5. (3)
6. (4)
7. (4)
8. (3)
9. (2)
10. (1)
11. (3)
12. (3)
13. (1)
14. (4)
15. (3)
16. (2)
17. (3)
18. (2)
19. (3)
20. (3)
21. (80)
22. (24)
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25. (80)

CHEMISTRY

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MATHEMATICS

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PART - A (PHYSICS)

1. Answer (1)

$$\text{Hint : } -\frac{d\theta}{dt} \propto \frac{A}{m}$$

$$\text{Sol. } -\frac{d\theta}{dt} = \frac{Kl^2}{\rho l^3}$$

$$\Rightarrow -\frac{d\theta}{dt} = \frac{k'}{l}$$

2. Answer (3)

$$\text{Hint : } U = \frac{nfRT}{2}$$

$$\text{Sol. : } U_i - U_f = 4 \times \frac{3RT}{2} - \frac{2 \times 5RT}{2} = RT$$

3. Answer (4)

$$\text{Hint : } (n_1 + n_2)C_v = n_1C_{v1} + n_2C_{v2}$$

$$\text{Sol. : } C_v = \frac{2 \times \frac{3R}{2} + 3 \times \frac{5R}{2}}{5} = \frac{21R}{10}$$

$$C_p = C_v + R = \frac{31R}{10}$$

4. Answer (1)

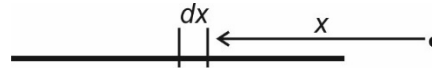
$$\text{Hint : } C = \frac{C_1 C_2}{C_1 + C_2}$$

$$\text{Sol. } C_1 = \frac{\epsilon_0 A}{\frac{d}{2} + vt}, C_2 = \frac{k\epsilon_0 A}{\frac{d}{2} - vt}$$

$$\begin{aligned} \frac{C_1 C_2}{C_1 + C_2} &= \frac{\frac{k(\epsilon_0 A)^2}{\left(\frac{d}{2} + vt\right)\left(\frac{d}{2} - vt\right)}}{\frac{\epsilon_0 A}{\frac{d}{2} + vt} + \frac{k\epsilon_0 A}{\frac{d}{2} - vt}} \\ &= \frac{k\epsilon_0 A}{\left(\frac{d}{2} - vt\right) + k\left(\frac{d}{2} + vt\right)} \end{aligned}$$

5. Answer (3)

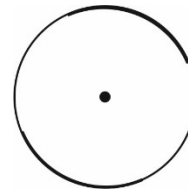
$$\text{Hint : } dE = \frac{kQ}{L} \frac{dx}{x^2}$$



$$\begin{aligned} \text{Sol. : } E &= \frac{kQ}{L} \int_L^{2L} \frac{dx}{x^2} \\ &= \frac{kQ}{L} \left(-\frac{1}{x} \right) \Big|_L^{2L} \\ &= \frac{kQ}{2L^2} = \frac{Q}{8\pi\epsilon_0 L^2} \end{aligned}$$

6. Answer (4)

$$\text{Hint : } dE = 2k \frac{\lambda}{R^2} R d\theta$$



$$\text{Sol. : } dE_x = \frac{2k\lambda}{R} \cos\theta d\theta$$

$$E_x = \frac{2k\lambda}{R} = \frac{1}{2\pi\epsilon_0} \cdot \frac{2Q}{\pi R} = \frac{Q}{\pi^2\epsilon_0 R^2}$$

$$E_y = E_x$$

$$\vec{E} = \frac{Q}{\pi^2\epsilon_0 R^2} (\hat{i} + \hat{j})$$

7. Answer (4)

$$\text{Hint : } U = k \left[\frac{q_1 q_2}{r_{12}} + \frac{q_2 q_3}{r_{23}} + \frac{q_3 q_1}{r_{31}} \right]$$

$$\text{Sol. : } = k \left[\frac{25 \times 10^{-12}}{l\sqrt{2}} + \frac{10 \times 10^{-6} Q_0}{l} \right] = 0$$

$$\Rightarrow Q_0 = -\frac{5 \times 10^{-6}}{2\sqrt{2}} \text{ C}$$

8. Answer (3)

Hint : $V = \frac{E_0}{k} 3 + E_0 t$

Sol. : $\frac{E_0}{5} \times 3 + E_0 t = E_0 \times 3$

$\Rightarrow \frac{3}{5} + t = 3$

$\Rightarrow t = 2.4 \text{ mm}$

9. Answer (2)

Hint : $\overset{0}{B} \overset{1}{B} \overset{2}{R} \overset{3}{O} \overset{4}{Y} \overset{5}{G} \overset{6}{B} \overset{7}{V} \overset{8}{G} \overset{9}{W}$ $\overset{5\%}{\text{Gold}}$ $\overset{10\%}{\text{Silver}}$

Sol. : $50 \times 10^7 \pm 5\%$

10. Answer (1)

Hint : $n_1 \lambda_1 = n_2 \lambda_2$

Sol. : $\frac{n_1}{n_2} = \frac{\lambda_2}{\lambda_1} = \frac{v_2}{v_1} = \sqrt{\frac{\rho_1}{\rho_2}}$

$\Rightarrow \frac{\rho_1}{\rho_2} = 9$

11. Answer (3)

Hint : $6800 = f \frac{320}{320 - 20} \times \frac{320 + 20}{320}$

Sol. : $f = \frac{6800 \times 300}{340} = 6000 \text{ Hz}$

12. Answer (3)

Hint : $L = n \frac{\lambda}{2}$

Sol. : $n = \frac{2L}{\lambda} = \frac{2 \times 80}{\lambda} = 10$

$\frac{2\pi}{\lambda} = \frac{\pi}{8}$

$\Rightarrow \lambda = 16 \text{ cm}$

13. Answer (1)

Hint : $\frac{10 \times R}{10 + R} = \frac{7 \times 10}{12}$

Sol. : $12R = 70 + 7R$

$\Rightarrow R = 14 \Omega$

14. Answer (4)

Hint : $P = \frac{v^2}{R}$

Sol. : $I = \frac{E}{\frac{10x}{10+x} + 10}$

$V = E - 10I = E - \frac{(10E)(10+x)}{20x+100}$

$= E - \frac{10(10+x)E}{20x+100}$

$P = \frac{v^2}{x} = E^2 \frac{(20x+100-100-10x)^2}{(20x+100)^2 x}$

$= \frac{E^2 10}{(20x+100)^2}$

$\frac{dP}{dx} = 0$

$\Rightarrow \frac{d}{dx} \frac{100x}{(20x+100)^2} = 0$

$\Rightarrow 100 \times (20x+100)^2$

$- 100 \times 2(20x+100) \times 20 = 0$

$\Rightarrow 20x + 100 = 40x$

$\Rightarrow x = 5 \Omega$

15. Answer (3)

Hint : $U = \frac{Q^2}{8\pi\epsilon_0 R}$

Sol. : $Q = \sqrt{8\pi\epsilon_0 R U}$

$= \sqrt{\frac{2}{9 \times 10^9} \times 6 \times 10^{-3} \times 27}$

$= 6 \mu\text{C}$

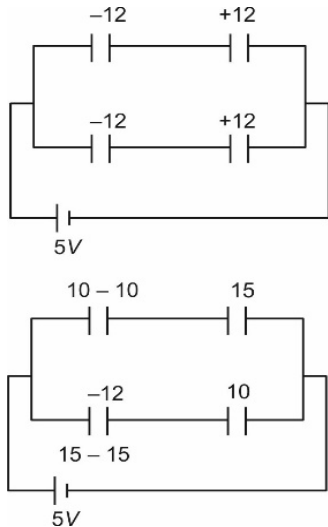
16. Answer (2)

Hint : $C_{\text{initial}} = 2 \times \frac{4 \times 6}{10} = 4.8 \mu\text{F}$

Sol. $q = CV = 2.4 \times 5 = 12.0 \mu\text{C}$

$C_{\text{final}} = 5 \mu\text{F}$

$q = 25 \mu\text{C}$



17. Answer (3)

Hint: Apply Kirchhoff's and Ohm's laws.

Sol. : $12 + 2 - 2R - 4 = 0$

$\Rightarrow 2R = 10$

$\Rightarrow R = 5 \Omega$

18. Answer (2)

Hint : Apply Gauss's law for a cylindrical Gaussian surface.

Sol. : $\phi = \frac{q_{\text{en}}}{\epsilon_0} = \frac{0.5 \times 2 \times 10^{-6}}{10^{-2} \epsilon_0} = \frac{10^{-4}}{\epsilon_0}$

19. Answer (3)

Hint : $E = \frac{\sigma}{4\epsilon_0} = \frac{Q}{4 \times 2\pi R^2 \epsilon_0}$

$= \frac{50 \times 10^{-9} \times 9 \times 10^9 \times 10^2}{2 \times 4}$

$= \frac{45}{8} \times 10^3 \text{ N/C}$

20. Answer (3)

Hint : $dQ = msdT$

Sol. : $Q = m \int_{10}^{30} AT^2 dT$

$= \frac{mA}{3} [27000 - 1000]$

$= \frac{26000}{3} \text{ mA}$

21. Answer (80)

Hint : $X = 20 + \frac{120}{100} \times 50$

Sol. : $X = 80$

22. Answer (24)

Hint : $Y = \frac{FL}{A\Delta L}$

Sol. : $F = YA \frac{\Delta L}{L} = YA \alpha \Delta T$

$= 2 \times 10^{11} \times 20 \times 10^{-4} \times 1.2 \times 10^{-5} \times 5$

$= 2 \times 20 \times 1.2 \times 5 \times 10^2 = 24000 \text{ N}$

23. Answer (15)

Hint : $Q_1 = W + Q_2$

$\frac{Q_1}{Q_2} = \frac{T_1}{T_2}$

Sol. : $Q_1 = \frac{T_1 Q_2}{T_2} = \frac{300}{273} \times 336 \times 10^3 \times 4$

$= 1.48 \times 10^6 \text{ J} = 14.8 \times 10^5 \text{ J}$

24. Answer (05)

Hint : Use equation of the straight line and ideal gas equation.

Sol. : $P = -\frac{P_0}{V_0} V + 4P$

$$\Rightarrow PV = nRT$$

$$\Rightarrow T = \frac{\frac{-P_0}{V_0}V^2 + 4P_0V}{2R}$$

$$\frac{dT}{dV} = 0 \Rightarrow \frac{-P_0}{V_0}2V + 4P_0 = 0$$

$$\Rightarrow V = 2V_0$$

$$T_{\max} = \frac{\frac{-P_0}{V_0} \cdot 4V_0^2 + 2P_0V_0}{2R}$$

$$= \frac{2P_0V_0}{R}$$

$$\Rightarrow n = 5$$

25. Answer (80)

Hint : $\frac{\lambda_a}{4} = l$

Sol. $\lambda_a = 4l$

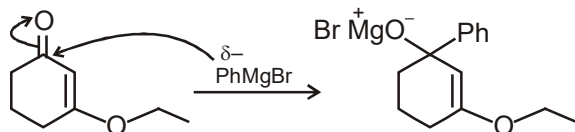
$$\Rightarrow \frac{320}{4l} = \frac{1}{0.5} \sqrt{\frac{200 \times 0.5}{40 \times 10^{-3}}}$$

$$\Rightarrow l = 80 \text{ cm}$$

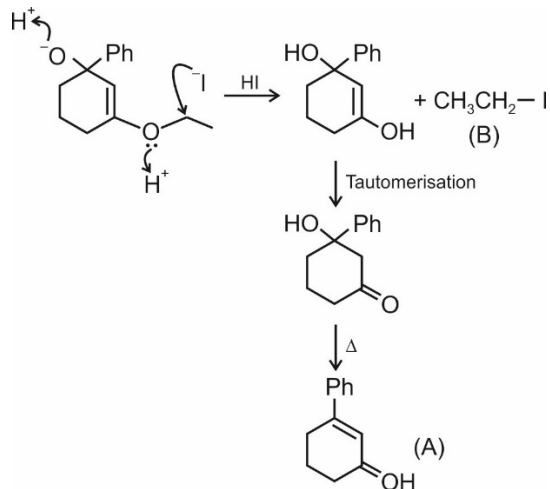
PART - B (CHEMISTRY)

26. Answer (2)

Hint :



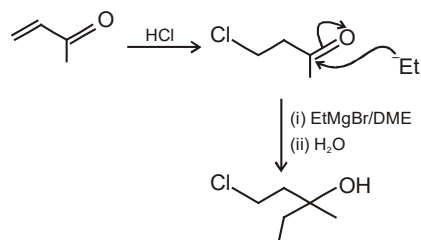
Sol. :



27. Answer (4)

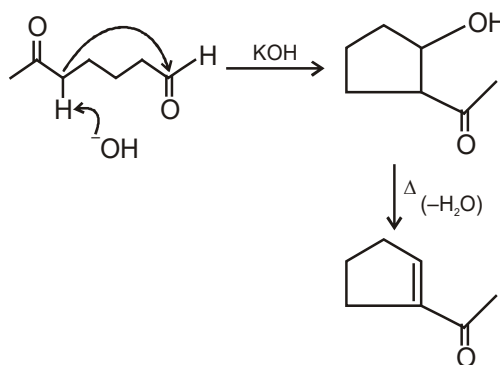
Hint : HCl has to be added at first, otherwise the -OH group will get substituted by -Cl.

Sol. :



28. Answer (1)

Hint :



Sol. : Ketones do not give positive Tollen's test. Since only water is lost from the reactant, so the decrease in mass will be of 18 g mol^{-1} .

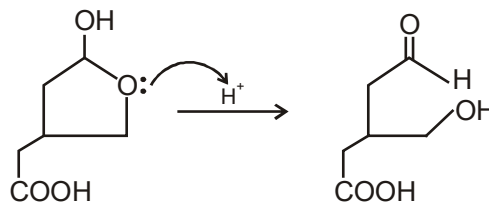
29. Answer (1)

Hint : Factual.

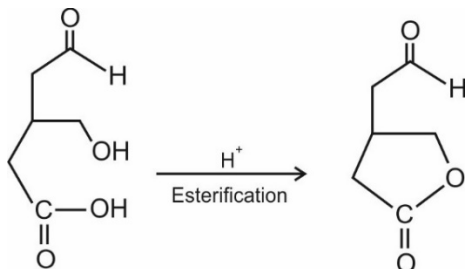
Sol. : DNA contain C, N, O and P.

30. Answer (1)

Hint :



Sol. :



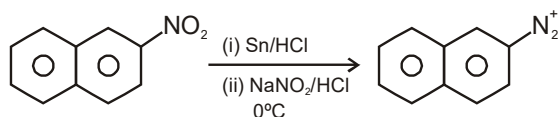
31. Answer (1)

Hint : Greater is the stabilisation of conjugate base, greater will be the acidic strength.

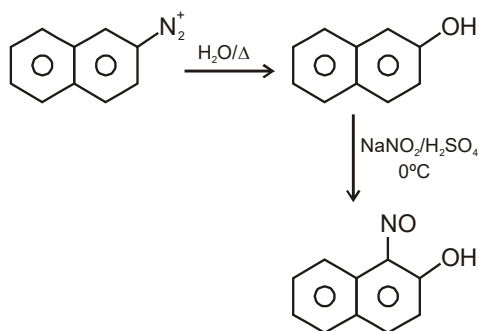
Sol. : $-R$ effect of $-\text{NO}_2$, $+I$ effect of $-\text{CH}_3$.

32. Answer (4)

Hint :



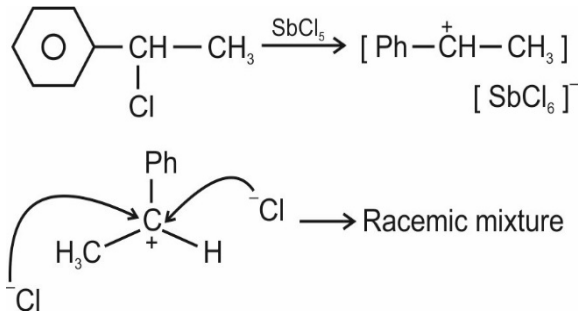
Sol. :



33. Answer (2)

Hint : SbCl_5 is a strong Lewis acid and by abstracting Cl^- , it has tendency to form carbocation.

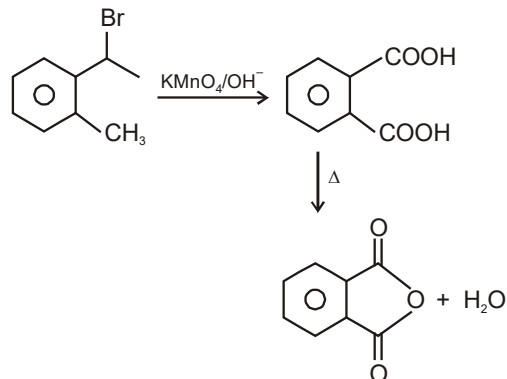
Sol. :



34. Answer (3)

Hint : $-\text{Br}$ group gives yellow ppt of AgBr with alcoholic AgNO_3 .

Sol. :



35. Answer (2)

Hint : Molisch's test is used to identify carbohydrates (sugars).

Sol. : Molisch's test : When a drop of an alcoholic solution of α -naphthol is added to sugar solution and conc. H_2SO_4 is then added along the sides of test tube, formation of violet ring takes place at the junction of two liquids.

36. Answer (3)

Hint : AlCl_3 is a Lewis acid.

Sol. : Lewis acid can initiate cationic polymerization.

37. Answer (2)

Hint : Glycine is having the least molecular mass among all the amino acids.

Sol. : Glycine is optically inactive.

38. Answer (1)

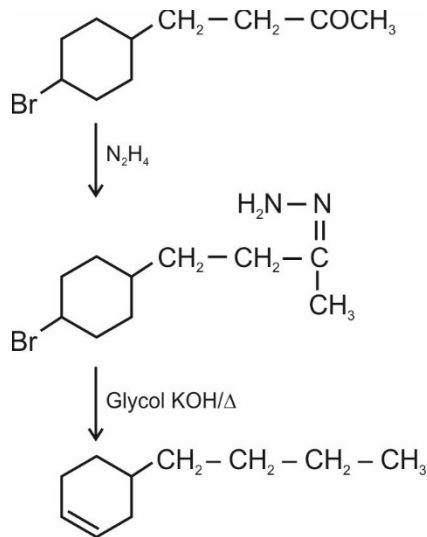
Hint : Due to intramolecular H-bonding o-nitrophenol is less soluble in water.

Sol. : Intramolecular H-bonding

39. Answer (4)

Hint : Glycol KOH behave same as alcoholic KOH and cause elimination of HBr.

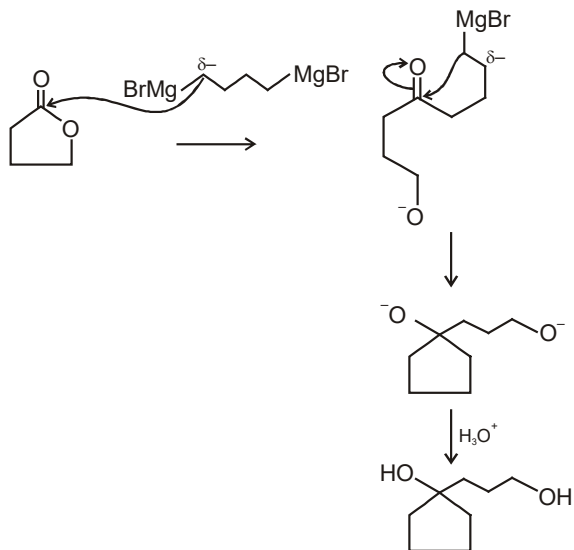
Sol. :



40. Answer (4)

Hint : Equivalent of a Grignard reagent can attack on a ester.

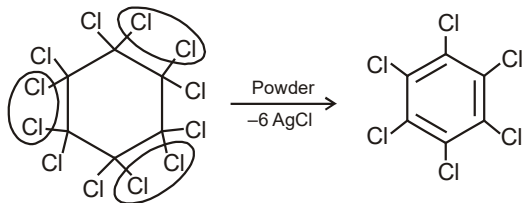
Sol. :



41. Answer (4)

Hint : Vicinal dihalides when treated with metals like Ag cause the formation of an alkene.

Sol. :



42. Answer (1)

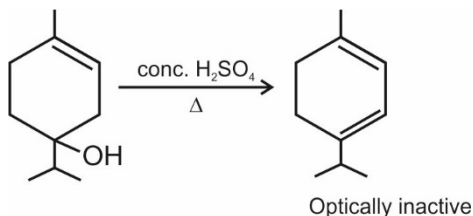
Hint : Teflon is a homopolymer of $CF_2 = CF_2$

Sol. :

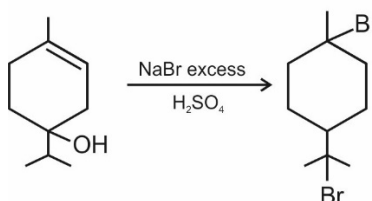
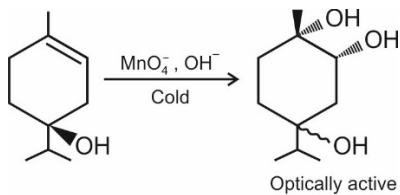


43. Answer (2)

Hint :



Sol. :



44. Answer (2)

Hint : Troposphere is dusty zone containing air, water vapour and clouds.

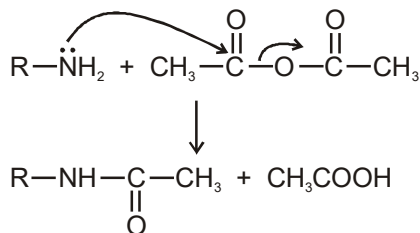
Sol. : Ozone is the part of stratosphere.

45. Answer (1)

Hint : All given type of interactions are involved in enzyme substrate complex.

Sol. : Factual.

46. Answer (09)

Hint :

Molecular weight per NH_2 by acylation is increased by 42.

Sol. : Total increase in molecular mass = $828 - 450 = 378$

$$\text{Number of } -\text{NH}_2 \text{ groups} = \frac{378}{42} = 9$$

47. Answer (00)

Hint : A carbon with all four different groups are chiral.

Sol. : All possible dichloro compounds for 2-methyl propane are optically inactive.

48. Answer (10)

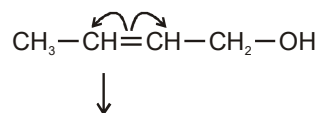
Hint : Equivalents of H_2SO_4 = Equivalents of NH_3 + Equivalents of NaOH

$$\text{Sol. : } 2 \times 120 \times \frac{1}{120} = \text{Eq. of } \text{NH}_3 + 40 \times \frac{1}{20}$$

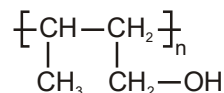
$$\text{meq. of } \text{NH}_3 = 10$$

$$\% \text{ of N} = \frac{10 \times 14 \times 10^{-3}}{1.4} \times 100 = 10\%$$

49. Answer (02)

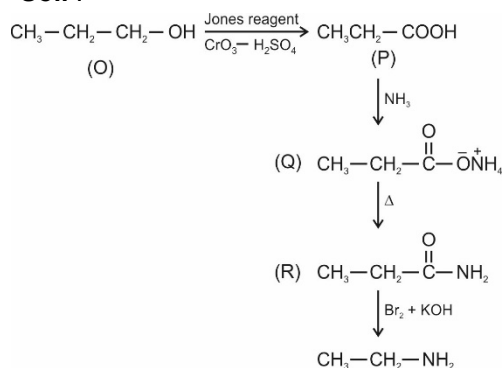
Hint : But-2-en-1-ol is

Sol. : When intermediates is polymerised will give



50. Answer (45)

Hint : An amine with molar mass equal to 45 g/mol only possible is $\text{CH}_3\text{CH}_2-\text{NH}_2$.

Sol. :

PART - C (MATHEMATICS)

51. Answer (3)

Hint : Conversion of Trigonometry

$$\text{Sol. : } u = \sin(\alpha + \beta) ; v = \sin(\alpha - \beta)$$

$$\begin{aligned}
 \Rightarrow 1 + uv &= 1 + \sin(\alpha + \beta)\sin(\alpha - \beta) \\
 &= 1 + \sin^2\alpha - \sin^2\beta \\
 &= \sin^2\alpha + \cos^2\beta
 \end{aligned}$$

52. Answer (1)

Hint : Domain of I.T.F

$$\text{Sol. : } \text{For real solution } \boxed{x = 2}$$

$$\Rightarrow 4m + \frac{\pi}{2} = 0$$

$$\Rightarrow \boxed{m = \frac{-\pi}{8}}$$

53. Answer (3)

Hint : Assumption of Parameter

Sol. : Let $A(m, 0)$ and $B(\alpha_1 - \alpha)$

$$\therefore AB = 4 \Rightarrow \boxed{(\alpha - m)^2 + \alpha^2 = 16}$$

$$\text{Midpoint } AB \left(\frac{m + \alpha}{2}, \frac{-\alpha}{2} \right)$$

$$\text{For locus } 2x = m + \alpha \Rightarrow m = 2x - \alpha$$

$$2y = -\alpha \Rightarrow (m - \alpha) = 2x + 4y$$

$$\therefore (2x + 4y)^2 + (2y)^2 = 16$$

$$\Rightarrow \boxed{x^2 + 4xy + 5y^2 = 4}$$

54. Answer (2)

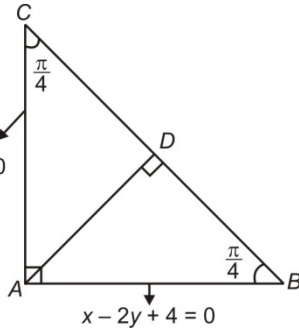
Hint : Method of Inspection.

Sol. : Orthocentre lies on altitude from 'A'.

\therefore Locus is $\boxed{x + y = 3}$

55. Answer (4)

Hint : Bisector of Lines



Sol. : $2x + y - 5 = 0$

Let $AD = a \Rightarrow AB = a\sqrt{2}$

Equation of bisectors of AB and AC are

$x + 3y = 9$ and $3x - y = 1$

Area = $\frac{1}{2} \times (\sqrt{2}a)^2 = a^2 = 10$

$\Rightarrow \boxed{a = \sqrt{10}}$

Equation of BC is

$x + 3y = \lambda$

$\Rightarrow \sqrt{10} = \frac{6 - \frac{39}{5} - \lambda}{\sqrt{10}} \Rightarrow \lambda = -1, 19$

$\therefore BC$ can be $x + 3y + 1 = 0$ or $x + 3y = 19$

Let equation of BC is

$3x - y = \lambda$

$\Rightarrow \sqrt{10} = \frac{18 - \frac{13}{5} - \lambda}{\sqrt{10}} \Rightarrow \lambda = -9, 11$

$\therefore BC$ can be $3x - y = 11$ or $3x - y + 9 = 0$

56. Answer (3)

Hint : Touching concept.

Sol. : $r = \sqrt{34 - k} < 3 \Rightarrow k > 25$

Also $1 + 25 - 6 - 50 + k < 0$

$\Rightarrow \boxed{k < 30} \Rightarrow k \in (25, 30)$

57. Answer (2)

Hint : Even of C.O.C. Comparison.

Sol. : Let $P(h, k)$ is fixed point

$\therefore xh + yk = 1 \dots (1)$

$2x + y = 4 \dots (2) \text{ (given)}$

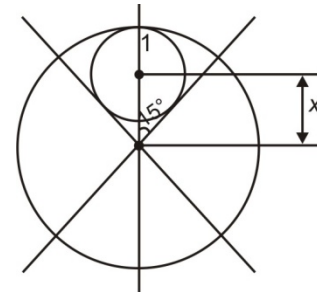
On comparing (1) and (2)

$\frac{h}{2} = \frac{k}{1} = \frac{1}{4}$

$\Rightarrow \boxed{h = \frac{1}{2}} \quad \boxed{k = \frac{1}{4}}$

58. Answer (1)

Hint : Sector concept



Sol. :

$\therefore x = \text{cosec}15^\circ$

\therefore larger radius of $c = x + 1 = 1 + \text{cosec}15^\circ$

$= 1 + \frac{2\sqrt{2}}{\sqrt{3} - 1}$

$= 1 + \sqrt{6} + \sqrt{2}$

59. Answer (3)

Hint : Sum of series by telescopic.

Sol. : $T_n = \tan^{-1}\left(\frac{4}{4n^2 + 3}\right) = \tan^{-1}\left(n + \frac{1}{2}\right) - \tan^{-1}\left(n - \frac{1}{2}\right)$

$\therefore S_n = \sum_{r=1}^n T_r = \frac{\pi}{2} - \tan^{-1}\frac{1}{2} = \tan^{-1}1 + \cot^{-1}3$

60. Answer (4)

Hint : Trigonometry conversion.

Sol. : $\cot(\sin^{-1}(\sin 4)) = \cot(\pi - 4) =$

$-\cot 4 < 0$ (Due to $\cot 4 > 0$)

$\cos(\tan^{-1}(\tan 4)) = \cos(4 - \pi) = -\cos 4 > 0$

$$\sin(\cot^{-1}(\cot 4)) = -\sin 4 > 0$$

$$\tan(\cos^{-1}(\cos 5)) = -\tan 5 > 0$$

61. Answer (2)

Hint : Equation of line in symmetry form.

Sol. : Let equation of chord

$$\frac{x-2}{\cos \theta} = \frac{y-1}{\sin \theta} = r \Rightarrow A(2+r \cos \theta, 1+r \sin \theta)$$

Lies on curve $y^2 = x$

$$\Rightarrow (1+r \sin \theta)^2 = 2+r \cos \theta$$

$$\Rightarrow \sin^2 \theta r^2 + (2 \sin \theta - \cos \theta)r - 1 = 0 \begin{matrix} r_1 \\ r_2 \end{matrix}$$

$$\therefore r_1 + r_2 = 0 \Rightarrow \tan \theta = \frac{1}{2}$$

$$\text{Now } P = \sqrt{(r_1 + r_2)^2 - 4r_1 r_2} = \sqrt{4 \times \frac{1}{\sin^2 \theta}} = \boxed{2\sqrt{5}}$$

$\therefore P^2 - 1 = 19$ has only two factors.

62. Answer (3)

Hint : Tangency on ellipse.

Sol. : Touching condition $4a^2 + b^2 = 4$

$$\therefore \frac{4a^2 + b^2}{2} \geq 2ab$$

$$\Rightarrow ab \leq 1$$

$$\therefore \text{Maximum area of ellipse} = \boxed{\pi}$$

63. Answer (4)

Hint : Geometrical property.

Sol. : By property $\alpha\beta = 25 = \gamma\delta$

$$\Rightarrow \boxed{\alpha\beta + \gamma\delta = 50}$$

64. Answer (3)

Hint : Comparison of Tangent.

Sol. : \therefore Any tangent on ellipse

$$y = mx \pm \sqrt{a^2 m^2 + b^2} \dots (1)$$

Comparing it with given line

$$m = \frac{-2p}{\sqrt{1-p^2}} \text{ and } a^2 m^2 + b^2 = \frac{1}{1-p^2}$$

$$\Rightarrow \frac{a^2 4p^2}{1-p^2} + b^2 = \frac{1}{1-p^2}$$

$$\Rightarrow p^2(4a^2 - b^2) + b^2 - 1 = 0$$

$$\Rightarrow 4a^2 - b^2 = 0 \text{ and } b^2 = 1$$

$$\Rightarrow a^2 = \frac{1}{4}$$

$$\therefore e = \sqrt{1 - \frac{1}{4}} = \boxed{\frac{\sqrt{3}}{2}}$$

65. Answer (2)

Hint : Property on parabola.

Sol. : By property of parabola

$$m = \frac{-1}{\frac{6-1}{3-1}} = \boxed{\frac{-2}{5}}$$

66. Answer (2)

Hint : Graphical concept.

Sol. : This is only possible when slope of line is negative.

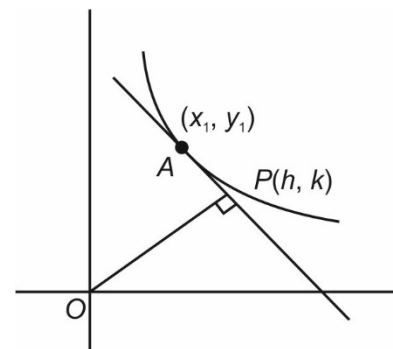
$$\Rightarrow -\lambda < 0 \Rightarrow \lambda > 0$$

$$\therefore \boxed{\lambda = \frac{4}{3}}$$
 is correct option.

67. Answer (1)

Hint : Tangent on any curve.

Sol. :



Let any tangent at A

$$\frac{x}{x_1} + \frac{y}{y_1} = 2 \dots (1)$$

$$x_1 \cdot y_1 = 2 \dots (2)$$

$$\text{Also } y_1 y = x_1 x \dots (3)$$

Square equation (1) and use (2) and (3) then

required locus is $(x^2 + y^2)^2 = 4xy$

68. Answer (4)

Hint : Concept of external touching.

Sol. : r is radius of required circle

$$\therefore 2\sqrt{rr_1} + 2\sqrt{rr_2} = 2\sqrt{r_1r_2}$$

$$\therefore \sqrt{r}(6+3) = 6 \times 3$$

$$\Rightarrow \boxed{r = 4}$$

69. Answer (3)

Hint : Truth values concept

Sol. : $p \rightarrow F ; q \rightarrow T ; r \rightarrow T$

$$\therefore \sim p \vee (q \wedge r) = \sim F \vee (T \wedge T) = T \vee T = T$$

70. Answer (4)

Hint : Types of Relation.

Sol. : $awa \Rightarrow a - a + \sqrt{2} = \sqrt{2}$

$\Rightarrow w$ is reflexive.

Let $a = \sqrt{2} ; b = 1$

$\Rightarrow \sqrt{2} w 1$ is true but $1 w \sqrt{2}$ is not true

$\therefore w$ is not symmetric.

Let $a = \sqrt{2}, b = 1 ; c = 2\sqrt{2}$ then awb and bwc is true but awc is not true.

$\therefore w$ is not transitive.

71. Answer (02)

Hint : Inverse Trigonometry function property.

Sol. : $f(x) + f(-x) = 2$ and $\sin^{-1}(\sin 9) = 3\pi - 9$

\therefore and $\tan^{-1}(\tan 9) = 9 - \pi \times 3$

$\therefore f(\tan^{-1}(\tan 9)) = 2 - k$

72. Answer (09)

Hint : Equality of two equation by graph of algebra.

Sol. : $\frac{2(-1+9|x|)}{9|x|} = 2 - \frac{2}{x^2 + 5|x| + 3}$

$$\Rightarrow \frac{-2}{9|x|} = \frac{-2}{x^2 + 5|x| + 3}$$

$$\Rightarrow x^2 - 4|x| + 3 = 0$$

73. Answer (08)

Hint : Assumption of normal

Sol. : Any normal at P is $\frac{5x}{\cos \theta} - \frac{3y}{\sin \theta} = 16$

Let $CR = r$

$\therefore R(r \cos \theta, r \sin \theta)$

$\Rightarrow 2r = 16 \Rightarrow \boxed{r = 8}$

74. Answer (13)

Hint : Homogenation concept

Sol. : Make hyperbola homogeneous by using line we get

$$4x^2 + 2\sqrt{3}xy = 0$$

$\therefore \tan \theta = 2 \left(\frac{\sqrt{3} - 0}{4 + 0} \right)$

$\Rightarrow \theta = \tan^{-1} \left(\frac{\sqrt{3}}{2} \right)$

$\Rightarrow m^2 + n^2 = 13$

75. Answer (01)

Hint : Co-efficient of $x^3 = 0$

Sol. : For $a = 2, -2, -1$ function is into



All India Aakash Test Series for JEE (Main)-2020

TEST - 2 - Code-F

Test Date : 17/11/2019

ANSWERS

PHYSICS

1. (3)
2. (3)
3. (2)
4. (3)
5. (2)
6. (3)
7. (4)
8. (1)
9. (3)
10. (3)
11. (1)
12. (2)
13. (3)
14. (4)
15. (4)
16. (3)
17. (1)
18. (4)
19. (3)
20. (1)
21. (80)
22. (05)
23. (15)
24. (24)
25. (80)

CHEMISTRY

26. (1)
27. (2)
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30. (4)
31. (4)
32. (4)
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MATHEMATICS

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70. (3)
71. (01)
72. (13)
73. (08)
74. (09)
75. (02)

PART - A (PHYSICS)

1. Answer (3)

$$\text{Hint : } dQ = msdT$$

$$\text{Sol. : } Q = m \int_{10}^{30} AT^2 dT$$

$$= \frac{mA}{3} [27000 - 1000]$$

$$= \frac{26000}{3} \text{ mA}$$

2. Answer (3)

$$\text{Hint : } E = \frac{\sigma}{4\epsilon_0} = \frac{Q}{4 \times 2\pi R^2 \epsilon_0}$$

$$= \frac{50 \times 10^{-9} \times 9 \times 10^9 \times 10^2}{2 \times 4}$$

$$= \frac{45}{8} \times 10^3 \text{ N/C}$$

3. Answer (2)

Hint : Apply Gauss's law for a cylindrical Gaussian surface.

$$\text{Sol. : } \phi = \frac{q_{\text{en}}}{\epsilon_0} = \frac{0.5 \times 2 \times 10^{-6}}{10^{-2} \epsilon_0} = \frac{10^{-4}}{\epsilon_0}$$

4. Answer (3)

Hint: Apply Kirchhoff's and Ohm's laws.

$$\text{Sol. : } 12 + 2 - 2R - 4 = 0$$

$$\Rightarrow 2R = 10$$

$$\Rightarrow R = 5 \Omega$$

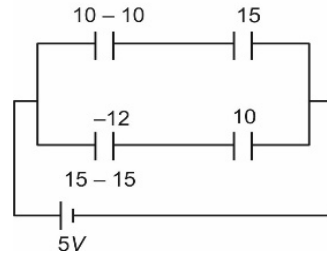
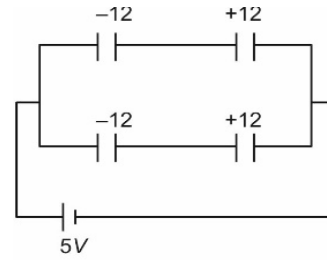
5. Answer (2)

$$\text{Hint : } C_{\text{initial}} = 2 \times \frac{4 \times 6}{10} = 4.8 \mu\text{F}$$

$$\text{Sol. } q = CV = 2.4 \times 5 = 12.0 \mu\text{C}$$

$$C_{\text{final}} = 5 \mu\text{F}$$

$$q = 25 \mu\text{C}$$



6. Answer (3)

$$\text{Hint : } U = \frac{Q^2}{8\pi\epsilon_0 R}$$

$$\text{Sol. : } Q = \sqrt{8\pi\epsilon_0 R U}$$

$$= \sqrt{\frac{2}{9 \times 10^9} \times 6 \times 10^{-3} \times 27}$$

$$= 6 \mu\text{C}$$

7. Answer (4)

$$\text{Hint : } P = \frac{V^2}{R}$$

$$\text{Sol. : } I = \frac{E}{\frac{10x}{10+x} + 10},$$

$$V = E - 10I = E - \frac{(10E)(10+x)}{20x+100}$$

$$= E - \frac{10(10+x)E}{20x+100}$$

$$P = \frac{V^2}{x} = E^2 \frac{(20x+100-100-10x)^2}{(20x+100)^2 x}$$

$$= \frac{E^2 10}{(20x+100)^2}$$

$$\frac{dP}{dx} = 0$$

$$\Rightarrow \frac{d}{dx} \frac{100x}{(20x+100)^2} = 0$$

$$\Rightarrow 100 \times (20x+100)^2 - 100 \times 2(20x+100) \times 20 = 0$$

$$\Rightarrow 20x+100 = 40x$$

$$\Rightarrow x = 5 \Omega$$

8. Answer (1)

Hint : $\frac{10 \times R}{10+R} = \frac{7 \times 10}{12}$

Sol. : $12R = 70 + 7R$
 $\Rightarrow R = 14 \Omega$

9. Answer (3)

Hint : $L = n \frac{\lambda}{2}$

Sol. : $n = \frac{2L}{\lambda} = \frac{2 \times 80}{\lambda} = 10$

$$\frac{2\pi}{\lambda} = \frac{\pi}{8}$$

$$\Rightarrow \lambda = 16 \text{ cm}$$

10. Answer (3)

Hint : $6800 = f \frac{320}{320-20} \times \frac{320+20}{320}$

Sol. : $f = \frac{6800 \times 300}{340} = 6000 \text{ Hz}$

11. Answer (1)

Hint : $n_1 \lambda_1 = n_2 \lambda_2$

Sol. : $\frac{n_1}{n_2} = \frac{\lambda_2}{\lambda_1} = \frac{v_2}{v_1} = \sqrt{\frac{\rho_1}{\rho_2}}$

$$\Rightarrow \frac{\rho_1}{\rho_2} = 9$$

12. Answer (2)

Hint : $\begin{matrix} 0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 5\% & 10\% \\ \text{B} & \text{B} & \text{R} & \text{O} & \text{Y} & \text{G} & \text{B} & \text{V} & \text{G} & \text{W} & \text{Gold} & \text{Silver} \end{matrix}$

Sol. : $50 \times 10^7 \pm 5\%$

13. Answer (3)

Hint : $V = \frac{E_0}{k} 3 + E_0 t$

Sol. : $\frac{E_0}{5} \times 3 + E_0 t = E_0 \times 3$

$$\Rightarrow \frac{3}{5} + t = 3$$

$$\Rightarrow t = 2.4 \text{ mm}$$

14. Answer (4)

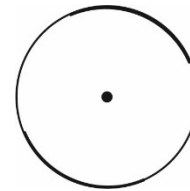
Hint : $U = k \left[\frac{q_1 q_2}{r_{12}} + \frac{q_2 q_3}{r_{23}} + \frac{q_3 q_1}{r_{31}} \right]$

Sol. : $= k \left[\frac{25 \times 10^{-12}}{l\sqrt{2}} + \frac{10 \times 10^{-6} Q_0}{l} \right] = 0$

$$\Rightarrow Q_0 = -\frac{5 \times 10^{-6}}{2\sqrt{2}} \text{ C}$$

15. Answer (4)

Hint : $dE = 2k \frac{\lambda}{R^2} R d\theta$



Sol. : $dE_x = \frac{2k\lambda}{R} \cos\theta d\theta$

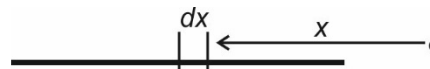
$$E_x = \frac{2k\lambda}{R} = \frac{1}{2\pi\epsilon_0} \cdot \frac{2Q}{\pi R} = \frac{Q}{\pi^2 \epsilon_0 R^2}$$

$$E_y = E_x$$

$$\vec{E} = \frac{Q}{\pi^2 \epsilon_0 R^2} (\hat{i} + \hat{j})$$

16. Answer (3)

Hint : $dE = \frac{kQ}{L} \frac{dx}{x^2}$



Sol. : $E = \frac{kQ}{L} \int_L^{2L} \frac{dx}{x^2}$

$$= \frac{kQ}{L} \left(-\frac{1}{x} \right) \Big|_L^{2L}$$

$$= \frac{kQ}{2L^2} = \frac{Q}{8\pi\epsilon_0 L^2}$$

17. Answer (1)

$$\text{Hint : } C = \frac{C_1 C_2}{C_1 + C_2}$$

$$\text{Sol. } C_1 = \frac{\epsilon_0 A}{\frac{d}{2} + vt}, C_2 = \frac{k\epsilon_0 A}{\frac{d}{2} - vt}$$

$$\begin{aligned} \frac{C_1 C_2}{C_1 + C_2} &= \frac{\left(\frac{d}{2} + vt\right)\left(\frac{d}{2} - vt\right)}{\frac{\epsilon_0 A}{\frac{d}{2} + vt} + \frac{k\epsilon_0 A}{\frac{d}{2} - vt}} \\ &= \frac{k(\epsilon_0 A)^2}{\left(\frac{d}{2} - vt\right) + k\left(\frac{d}{2} + vt\right)} \end{aligned}$$

18. Answer (4)

$$\text{Hint : } (n_1 + n_2)C_v = n_1 C_{v1} + n_2 C_{v2}$$

$$\text{Sol. : } C_v = \frac{2 \times \frac{3R}{2} + 3 \times \frac{5R}{2}}{5} = \frac{21R}{10}$$

$$C_p = C_v + R = \frac{31R}{10}$$

19. Answer (3)

$$\text{Hint : } U = \frac{nfRT}{2}$$

$$\text{Sol. : } U_i - U_f = 4 \times \frac{3RT}{2} - \frac{2 \times 5RT}{2} = RT$$

20. Answer (1)

$$\text{Hint : } -\frac{d\theta}{dt} \propto \frac{A}{m}$$

$$\text{Sol. } -\frac{d\theta}{dt} = \frac{Kl^2}{\rho l^3}$$

$$\Rightarrow -\frac{d\theta}{dt} = \frac{k'}{l}$$

21. Answer (80)

$$\text{Hint : } \frac{\lambda_a}{4} = l$$

$$\text{Sol. } \lambda_a = 4l$$

$$\Rightarrow \frac{320}{4l} = \frac{1}{0.5} \sqrt{\frac{200 \times 0.5}{40 \times 10^{-3}}}$$

$$\Rightarrow l = 80 \text{ cm}$$

22. Answer (05)

Hint : Use equation of the straight line and ideal gas equation.

$$\text{Sol. : } P = -\frac{P_0}{V_0}V + 4P_0$$

$$\Rightarrow PV = nRT$$

$$\Rightarrow T = \frac{-\frac{P_0}{V_0}V^2 + 4P_0V}{2R}$$

$$\frac{dT}{dV} = 0 \Rightarrow -\frac{P_0}{V_0}2V + 4P_0 = 0$$

$$\Rightarrow V = 2V_0$$

$$T_{\max} = \frac{-\frac{P_0}{V_0} \cdot 4V_0^2 + 2P_0V_0}{2R}$$

$$= \frac{2P_0V_0}{R}$$

$$\Rightarrow n = 5$$

23. Answer (15)

$$\text{Hint : } Q_1 = W + Q_2$$

$$\frac{Q_1}{Q_2} = \frac{T_1}{T_2}$$

$$\text{Sol. : } Q_1 = \frac{T_1 Q_2}{T_2} = \frac{300}{273} \times 336 \times 10^3 \times 4$$

$$= 1.48 \times 10^6 \text{ J} = 14.8 \times 10^5 \text{ J}$$

24. Answer (24)

$$\text{Hint : } Y = \frac{FL}{A\Delta L}$$

Sol. : $F = YA \frac{\Delta L}{L} = YA \alpha \Delta T$

$$= 2 \times 10^{11} \times 20 \times 10^{-4} \times 1.2 \times 10^{-5} \times 5$$

$$= 2 \times 20 \times 1.2 \times 5 \times 10^2 = 24000 \text{ N}$$

25. Answer (80)

Hint : $X = 20 + \frac{120}{100} \times 50$

Sol. : $X = 80$

PART - B (CHEMISTRY)

26. Answer (1)

Hint : All given type of interactions are involved in enzyme substrate complex.

Sol. : Factual.

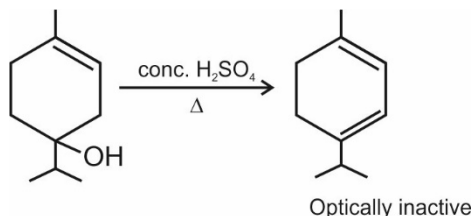
27. Answer (2)

Hint : Troposphere is dusty zone containing air, water vapour and clouds.

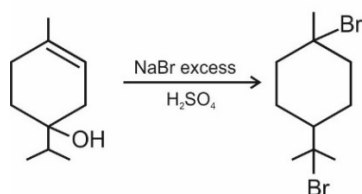
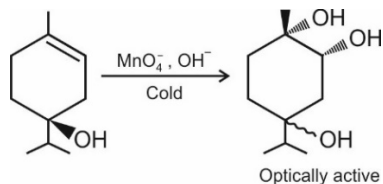
Sol. : Ozone is the part of stratosphere.

28. Answer (2)

Hint :



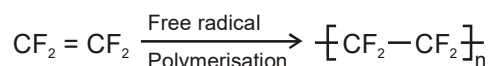
Sol. :



29. Answer (1)

Hint : Teflon is a homopolymer of $\text{CF}_2 = \text{CF}_2$

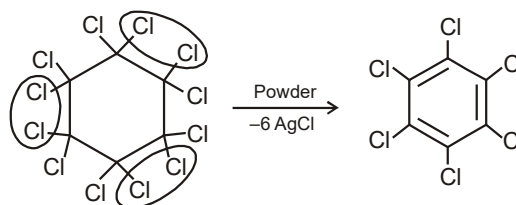
Sol. :



30. Answer (4)

Hint : Vicinal dihalides when treated with metals like Ag cause the formation of an alkene.

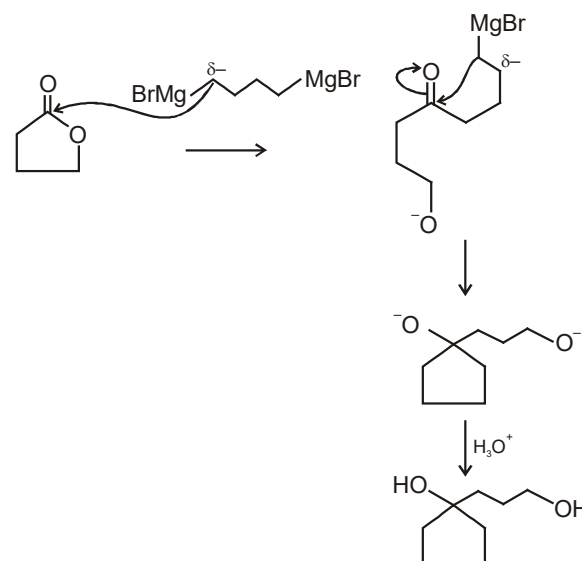
Sol. :



31. Answer (4)

Hint : Equivalent of a Grignard reagent can attack on an ester.

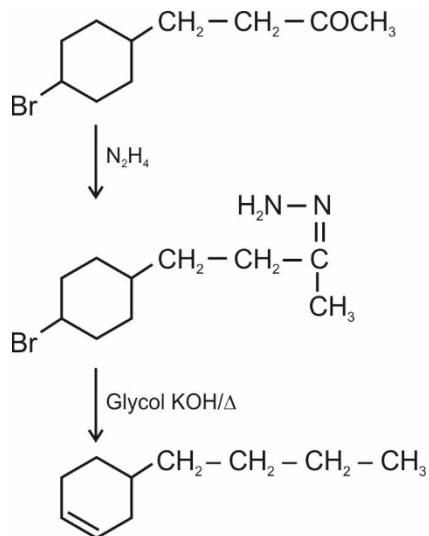
Sol. :



32. Answer (4)

Hint : Glycol KOH behave same as alcoholic KOH and cause elimination of HBr.

Sol. :



33. Answer (1)

Hint : Due to intramolecular H-bonding o-nitrophenol is less soluble in water.

Sol. :



34. Answer (C)

Hint : Glycine is having the least molecular mass among all the amino acids.

Sol. : Glycine is optically inactive.

35. Answer (3)

Hint : $AlCl_3$ is a Lewis acid.

Sol. : Lewis acid can initiate cationic polymerization.

36. Answer (2)

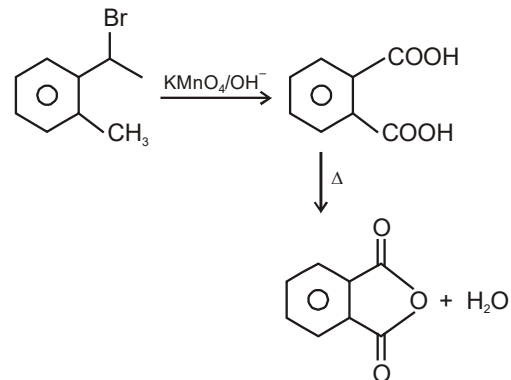
Hint : Molisch's test is used to identify carbohydrates (sugars).

Sol. : Molisch's test : When a drop of an alcoholic solution of α -naphthol is added to sugar solution and conc. H_2SO_4 is then added along the sides of test tube, formation of violet ring takes place at the junction of two liquids.

37. Answer (3)

Hint : $-Br$ group gives yellow ppt of AgBr with alcoholic $AgNO_3$.

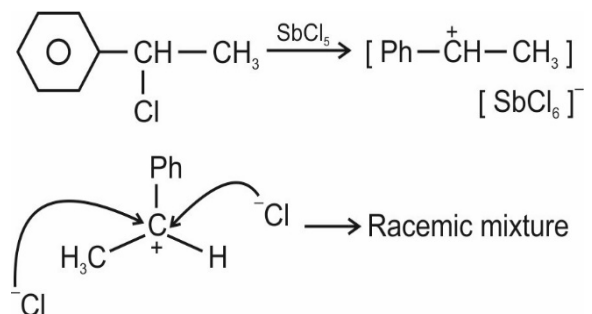
Sol. :



38. Answer (2)

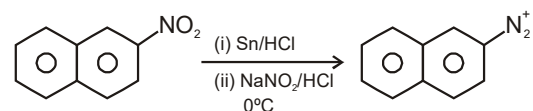
Hint : $SbCl_5$ is a strong Lewis acid and by abstracting Cl^- , it has tendency to form carbocation.

Sol. :

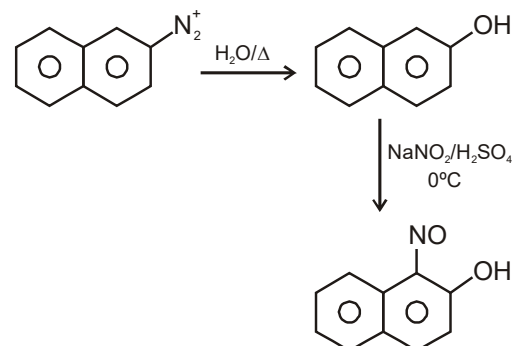


39. Answer (4)

Hint :



Sol. :



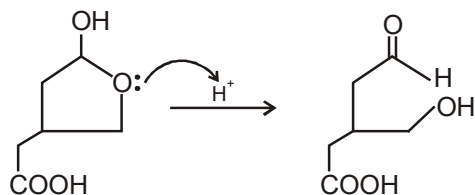
40. Answer (1)

Hint : Greater is the stabilisation of conjugate base, greater will be the acidic strength.

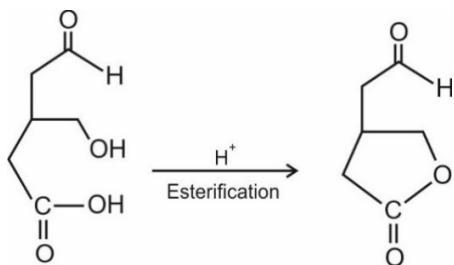
Sol. : $-R$ effect of $-\text{NO}_2$, $+I$ effect of $-\text{CH}_3$.

41. Answer (1)

Hint :



Sol. :



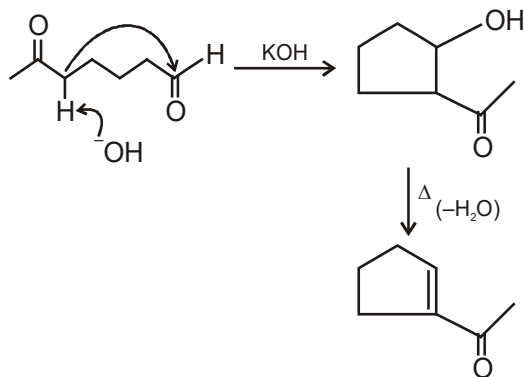
42. Answer (1)

Hint : Factual.

Sol. : DNA contain C, N, O and P.

43. Answer (1)

Hint :



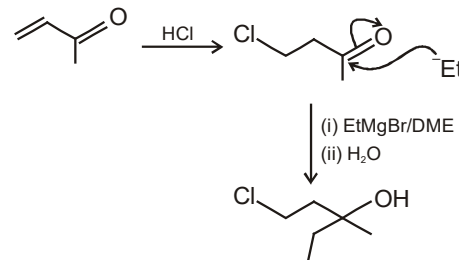
Sol. : Ketones do not give positive Tollen's test.

Since only water is lost from the reactant, so the decrease in mass will be of 18 g mol^{-1} .

44. Answer (4)

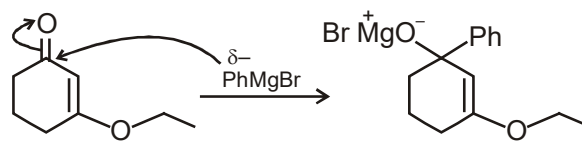
Hint : HCl has to be added at first, otherwise the $-\text{OH}$ group will get substituted by $-\text{Cl}$.

Sol. :

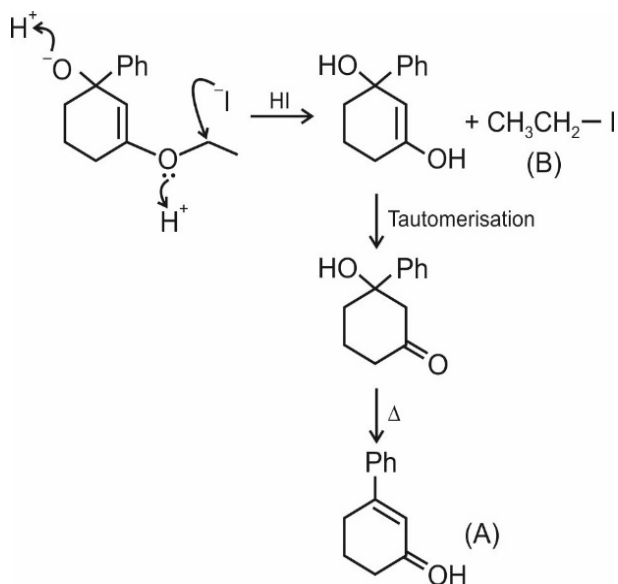


45. Answer (2)

Hint :



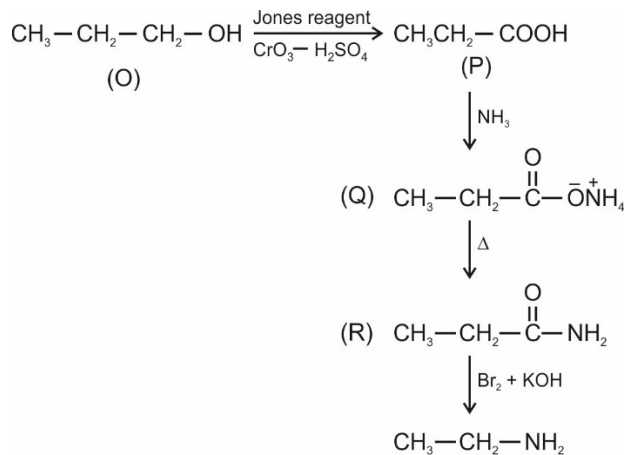
Sol. :



46. Answer (45)

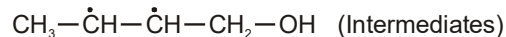
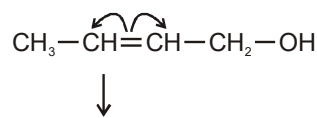
Hint : An amine with molar mass equal to 45 g/mol only possible is $\text{CH}_3\text{CH}_2-\text{NH}_2$.

Sol. :

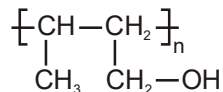


47. Answer (02)

Hint : But-2-en-1-ol is



Sol. : When intermediates is polymerised will give



48. Answer (10)

Hint : Equivalent of H_2SO_4 = Equivalent of NH_3 + Equivalent of NaOH

$$\text{Sol. : } 2 \times 120 \times \frac{1}{120} = \text{Eq. of } \text{NH}_3 + 40 \times \frac{1}{20}$$

meq. of NH_3 = 10

$$\% \text{ of N} = \frac{10 \times 14 \times 10^{-3}}{1.4} \times 100 = 10\%$$

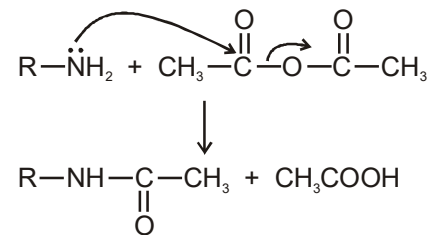
49. Answer (00)

Hint : A carbon with all four different groups are chiral.

Sol. : All possible dichloro compounds for 2-methyl propane are optically inactive.

50. Answer (09)

Hint :

Molecular weight per NH_2 by acylation is increased by 42.Sol. : Total increase in molecular mass = $828 - 450 = 378$

$$\text{Number of } -\text{NH}_2 \text{ groups} = \frac{378}{42} = 9$$

PART - C (MATHEMATICS)

51. Answer (4)

Hint : Types of Relation.

$$\text{Sol. : } awa \Rightarrow a - a + \sqrt{2} = \sqrt{2}$$

 $\Rightarrow w$ is reflexive.

$$\text{Let } a = \sqrt{2} ; b = 1$$

$$\Rightarrow \sqrt{2} w 1 \text{ is true but } 1 w \sqrt{2} \text{ is not true}$$

 $\therefore w$ is not symmetric.

Let $a = \sqrt{2}$, $b = 1$; $c = 2\sqrt{2}$ then awb and bwc is true but awc is not true.

 $\therefore w$ is not transitive.

52. Answer (3)

Hint : Truth values concept

$$\text{Sol. : } p \rightarrow F ; q \rightarrow T ; r \rightarrow T$$

$$\therefore \sim p \vee (q \wedge r) = \sim F \vee (T \wedge T)$$

$$= T \vee T = T$$

53. Answer (4)

Hint : Concept of external touching.

Sol. : r is radius of required circle

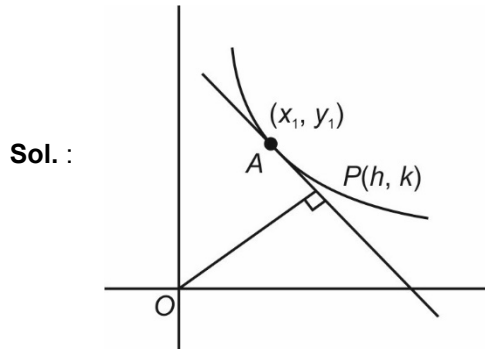
$$\therefore 2\sqrt{rr_1} + 2\sqrt{rr_2} = 2\sqrt{r_1r_2}$$

$$\therefore \sqrt{r} (6 + 3) = 6 \times 3$$

$$\Rightarrow \boxed{r = 4}$$

54. Answer (1)

Hint : Tangent on any curve.



Let any tangent at A

$$\frac{x}{x_1} + \frac{y}{y_1} = 2 \quad \dots (1)$$

$$x_1 \cdot y_1 = 2 \quad \dots (2)$$

$$\text{Also } y_1 y = x_1 x \quad \dots (3)$$

Square equation (1) and use (2) and (3) then

required locus is $(x^2 + y^2)^2 = 4xy$

55. Answer (2)

Hint : Graphical concept.

Sol. : This is only possible when slope of line is negative.

$$\Rightarrow -\lambda < 0 \quad \Rightarrow \lambda > 0$$

$$\therefore \lambda = \frac{4}{3} \text{ is correct option.}$$

56. Answer (2)

Hint : Property on parabola.

Sol. : By property of parabola

$$m = \frac{-1}{\frac{6-1}{3-1}} = \frac{-2}{5}$$

57. Answer (3)

Hint : Comparison of Tangent.

Sol. : \therefore Any tangent on ellipse

$$y = mx \pm \sqrt{a^2 m^2 + b^2} \quad \dots (1)$$

Comparing it with given line

$$m = \frac{-2p}{\sqrt{1-p^2}} \text{ and } a^2 m^2 + b^2 = \frac{1}{1-p^2}$$

$$\Rightarrow \frac{a^2 4p^2}{1-p^2} + b^2 = \frac{1}{1-p^2}$$

$$\Rightarrow p^2(4a^2 - b^2) + b^2 - 1 = 0$$

$$\Rightarrow 4a^2 - b^2 = 0 \text{ and } b^2 = 1$$

$$\Rightarrow a^2 = \frac{1}{4}$$

$$\therefore e = \sqrt{1 - \frac{1}{4}} = \frac{\sqrt{3}}{2}$$

58. Answer (4)

Hint : Geometrical property.

Sol. : By property $\alpha\beta = 25 = \gamma\delta$

$$\Rightarrow \alpha\beta + \gamma\delta = 50$$

59. Answer (3)

Hint : Tangency on ellipse.

Sol. : Touching condition $4a^2 + b^2 = 4$

$$\therefore \frac{4a^2 + b^2}{2} \geq 2ab$$

$$\Rightarrow ab \leq 1$$

$$\therefore \text{Maximum area of ellipse} = \pi$$

60. Answer (2)

Hint : Equation of line in symmetry form.

Sol. : Let equation of chord

$$\frac{x-2}{\cos\theta} = \frac{y-1}{\sin\theta} = r \Rightarrow A(2+r\cos\theta, 1+r\sin\theta)$$

Lies on curve $y^2 = x$

$$\Rightarrow (1+r\sin\theta)^2 = 2+r\cos\theta$$

$$\Rightarrow \sin^2\theta r^2 + (2\sin\theta - \cos\theta)r - 1 = 0 \begin{matrix} r_1 \\ r_2 \end{matrix}$$

$$\therefore r_1 + r_2 = 0 \Rightarrow \tan\theta = \frac{1}{2}$$

$$\text{Now } P = \sqrt{(r_1 + r_2)^2 - 4r_1 r_2} = \sqrt{4 \times \frac{1}{\sin^2\theta}} = 2\sqrt{5}$$

$\therefore P^2 - 1 = 19$ has only two factors.

67. Answer (2)

Hint : Method of Inspection.

Sol. : Orthocentre lies on altitude from 'A'.

$$\therefore \text{Locus is } \boxed{x + y = 3}$$

68. Answer (3)

Hint : Assumption of Parameter

Sol. : Let $A(m, 0)$ and $B(\alpha, -\alpha)$

$$\therefore AB = 4 \Rightarrow \boxed{(\alpha - m)^2 + \alpha^2 = 16}$$

$$\text{Mid-point } AB \left(\frac{m + \alpha}{2}, \frac{-\alpha}{2} \right)$$

$$\text{For locus } 2x = m + \alpha \Rightarrow m = 2x + 2y$$

$$2y = -\alpha \Rightarrow (m - \alpha) = 2x + 4y$$

$$\therefore (2x + 4y)^2 + (2y)^2 = 16$$

$$\Rightarrow \boxed{x^2 + 4xy + 5y^2 = 4}$$

69. Answer (1)

Hint : Domain of I.T.F

Sol. : For real solution $\boxed{x = 2}$

$$\Rightarrow 4m + \frac{\pi}{2} = 0$$

$$\Rightarrow \boxed{m = \frac{-\pi}{8}}$$

70. Answer (3)

Hint : Conversion of Trigonometry

Sol. : $u = \sin(\alpha + \beta)$; $v = \sin(\alpha - \beta)$

$$\Rightarrow 1 + uv = 1 + \sin(\alpha + \beta)\sin(\alpha - \beta)$$

$$= 1 + \sin^2\alpha - \sin^2\beta$$

$$= \sin^2\alpha + \cos^2\beta$$

71. Answer (01)

Hint : Co-efficient of $x^3 = 0$

Sol. : For $a = 2, -2, -1$ function is into

72. Answer (13)

Hint : Homogenation concept

Sol. : Make hyperbola homogeneous by using line we get

$$4x^2 + 2\sqrt{3}xy = 0$$

$$\therefore \tan\theta = 2 \left(\frac{\sqrt{3} - 0}{4 + 0} \right)$$

$$\Rightarrow \theta = \tan^{-1} \left(\frac{\sqrt{3}}{2} \right)$$

$$\Rightarrow m^2 + n^2 = 13$$

73. Answer (08)

Hint : Assumption of normal

Sol. : Any normal at P is $\boxed{\frac{5x}{\cos\theta} - \frac{3y}{\sin\theta} = 16}$

Let $CR = r$

$$\therefore R(r \cos\theta, r \sin\theta)$$

$$\Rightarrow 2r = 16 \Rightarrow \boxed{r = 8}$$

74. Answer (09)

Hint : Equality of two equation by graph of algebra.

$$\text{Sol. : } \frac{2(-1+9|x|)}{9|x|} = 2 - \frac{2}{x^2 + 5|x| + 3}$$

$$\Rightarrow \frac{-2}{9|x|} = \frac{-2}{x^2 + 5|x| + 3}$$

$$\Rightarrow x^2 - 4|x| + 3 = 0$$

75. Answer (02)

Hint : Inverse Trigonometry function property.

Sol. : $f(x) + f(-x) = 2$ and $\sin^{-1}(\sin 9) = 3\pi - 9$

$$\therefore \text{and } \tan^{-1}(\tan 9) = 9 - \pi \times 3$$

$$\therefore f(\tan^{-1}(\tan 9)) = 2 - k$$

