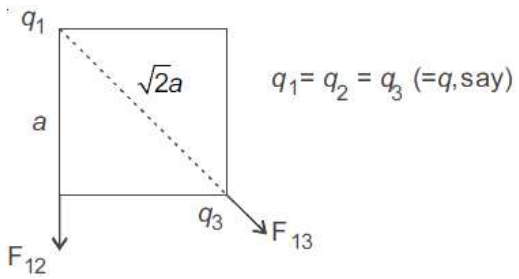
Physics

1. (c)



$q_1 = q_2 = q_3$ (=q, say)

$$F_{12} = \frac{kq_1q_2}{a^2} = \frac{kq^2}{a^2}$$

$$F_{13} = \frac{kq_1q_3}{(\sqrt{2}a)^2} = \frac{kq^2}{2a^2}$$

$$\frac{F_{13}}{F_{12}} = \frac{1}{2}$$

2. (a) $\phi = \frac{q}{\varepsilon_0}$

$\Rightarrow \phi \propto q$

$\therefore \frac{\phi'}{\phi} = \frac{q'}{q} = \frac{20\mu C}{10\mu C}$

$= \phi' = 2\phi$

3. (d) In medium $F' = \frac{F}{K} = \frac{16}{2}$

$= 8$ N

4. (c)

5. (d) Potential due to dipole

$$V = \frac{kp\cos\theta}{r^2}$$

on axis,

$\theta = 0$

$\therefore V = \frac{kp}{r^2} \neq 0$ on equator

$\theta = 90°$ $V = 0$

6. (a) $\frac{\sigma}{\rho} = \frac{1}{\rho^2}$

ρ increases when temperature is increased. Thus, the given ratio decreases.

7. (c) Minimum possible resistance is obtained when all resistors are connected in parallel

$$R_{min} = \frac{2}{10} = 0.2\Omega$$

Maximum possible resistance is obtained when all resistors are connected in series.

$R_{max} = 2 \times 10 = 20\Omega$

8. (d) $\mu = \frac{V_d}{E}$

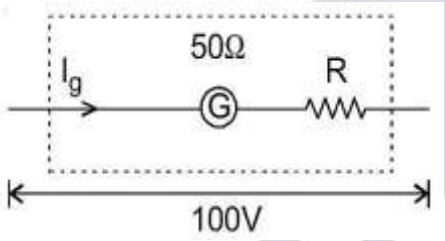
$$[\mu] = \frac{[V_d]}{[E]} = \frac{[V_d][q]}{[F]}$$
$$= \frac{[LT^{-1}][AT]}{[MLT^{-2}]}$$
$$= [M^{-1}\ L^0\ T^2\ A]$$

9. (a) $r = \frac{mv}{qB}$

$$= B = \frac{mv}{qr} = \frac{9.1 \times 10^{-31} \times 10^6}{1.6 \times 10^{-19} \times 0.2}$$

$$= 2.84 \times 10^{-5}\ T$$

10. (c)

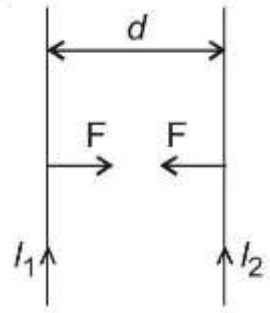


Using Ohm's law

$100 = I_g(50 + R)$
$100 = 10 \times 10^{-3}(R + 50)$
$= R + 50 = 10000$
$= R = 9950\Omega$

11. (b) Force per unit length is given by

$$F = \frac{\mu_0 I_1 I_2}{2\pi d}$$
$$= \frac{4\pi \times 10^{-7} \times 5 \times 5}{2\pi \times 1}$$
$$= 5 \times 10^{-6}\ N$$

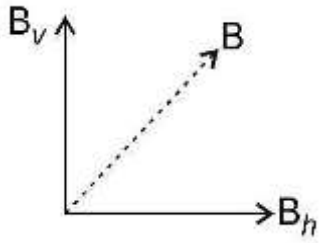


12. (d) Magnetic field inside a wire is given by

$B = \frac{\mu_0 ia}{2\pi r^2}$
$\Rightarrow B \propto a$

13. (c) Paramagnetic material is weakly attracted towards strong magnetic field.

14. (c) From the diagram



$B = \sqrt{B_h^2 + B_v^2}$

15. (d) Power of combination of lenses is given by

$$P = P_1 + P_2 = \frac{1}{f_1} + \frac{1}{f_2}$$
$$= P = \frac{f_1 + f_2}{f_1 f_2}$$

16. (a) Intensity in raylength scattering depends on wavelength as

$I \propto \frac{1}{\lambda^4}$
$\frac{I'}{I} = \left(\frac{\lambda}{\lambda'}\right)^4$
$= \left(\frac{8000\text{Å}}{4000\text{Å}}\right)^4 = 16$

17. (b) $\delta = (\mu - 1)A$

$\Rightarrow 3.6 = (1.6 - 1)A$

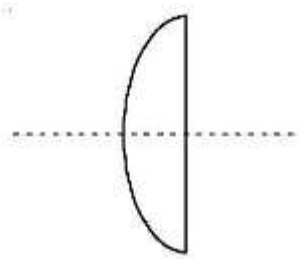
$\Rightarrow A = 6°$

18. (b)

$\frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$

$= \frac{1}{f} = (1.5 - 1)\left(\frac{1}{60} - \frac{1}{\infty}\right)$

$= f = 120$ cm



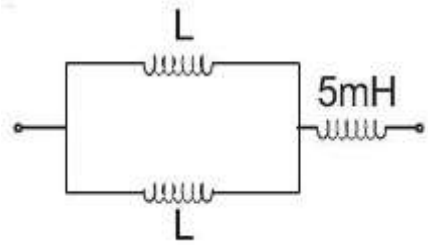
19. (c) As per principle of uncertainty

$$\Delta p \cdot \Delta x \simeq \frac{h}{2\pi}$$
$$\Rightarrow \Delta p = \frac{h}{2\pi\Delta x} = \frac{6.626 \times 10^{-34}}{2 \times 3.14 \times 10^{-10}}$$
$$= 1.05 \times 10^{-24}\ \text{kg} - \text{m/s}$$

20. (d) $E = \frac{hC}{\lambda}$

$$E \propto \frac{1}{\lambda}$$
$$\therefore \frac{E_2}{E_1} = \frac{\lambda_1}{\lambda_2}$$
$$= \frac{E_2}{3.2 \times 10^{-19}} = \frac{6000\text{Å}}{4000\text{Å}}$$
$$= E_2 = \frac{3}{2} \times 3.2 \times 10^{-19}$$
$$= 4.8 \times 10^{-19}\ \text{J}$$

21. (d)



Equivalent inductance is given by

$$L_{eq} = \left(\frac{L \times L}{L + L}\right) + 5 = 15(\text{ in mH})$$
$$= \frac{L}{2} = 10$$
$$= L = 20\text{mH}$$

22. (b) $P = VI\cos\phi$

$$P_{max} = VI$$

Given

$$P = \frac{P_{max}}{2}$$

$\Rightarrow VI\cos\phi = \frac{VI}{2}$

$\Rightarrow \cos\phi = \frac{1}{2}$

$\Rightarrow \phi = \frac{\pi}{3}$

23. (d) For D.C. source

$\omega = 0,$

Capacitive reactance

$X_C = \frac{1}{\omega C} = \infty$

24. (c) Speed of light

$$c = \frac{1}{\sqrt{\mu_0 \varepsilon_0}}$$
$$c^2 = \frac{1}{\mu_0 \varepsilon_0}$$
$$= \mu_0 \varepsilon_0 = \frac{1}{c^2}$$
$$\therefore [\mu_0 \varepsilon_0] = \frac{1}{[c]^2} = \frac{1}{[LT^{-1}]^2}$$
$$= [L^{-2}T^2] = [M^0\ L^{-2}\ T^2]$$

25. (b) (i) Interference patterns can be observed only when coherent sources are used.

(ii) Brewster's Law gives angle of polarization $\tan\theta_p = \mu$
(iii) Malus law gives intensity of light after passing through polarizer $I = I_0\cos^2\theta$

(iv) Critical angle for total internal reflection is given by relation

$\sin C = \frac{1}{\mu}$

26. (b)

27. (b) $E = \frac{hC}{\lambda}$

$E \propto Z^2$

$\therefore \frac{1}{\lambda} \propto Z^2$

$= \lambda \propto \frac{1}{\sqrt{Z}}$

28. (c)

29. (d) In α-decay (^4_2He) mass number decreases by 4 and atomic no. decreases by 2 .
In β^- −decay ($n \rightarrow p^+ + e^-$) mass number remains same while atomic no. increases by 1 .

$$Z^AX \xrightarrow{\beta^- \text{decay}} {}^{A}_{Z+1}X \xrightarrow{\beta^- \text{decay}}$$

$$Z^A_{Z+2}X_2 \xrightarrow{\alpha\text{-decay}} Z^{A-4}X_3 \xrightarrow{\beta^-\text{-decay}} {}^{A}_{Z+1}-4X_4$$

30. (a)

31. (b)

$$A_{max} = 15\ V$$
$$= A_c + A_m = 15\ V \ldots\ldots\ldots (A)$$
$$A_{min} = 10\ V$$
$$A_c - A_m = 10\ V \ldots\ldots . (B)$$

from (A) - (B)

$$2A_m = 5$$

from (A) + (B)

$$2\ A_c = 25$$

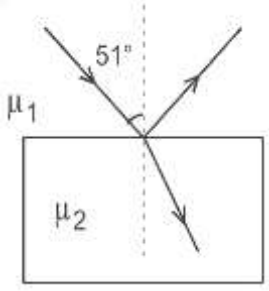
modulation index,

$$\mu = \frac{A_m}{A_c} = \frac{5}{25} = \frac{1}{5}$$
$$= \frac{1}{5} \times 100\% = 20\%$$

32. (c)

33. (d) Using Brewster's law

$$\tan\theta_p = \mu_{21} = \frac{\mu_2}{\mu_1}$$
$$= \tan 51^\circ = \frac{\mu_2}{1.4}$$
$$= \mu_2 = 1.4 \times 1.235$$
$$= 1.73$$



34. (b)

$$E = \frac{\Delta\phi}{\Delta t} = \frac{N(\Delta B)A}{\Delta t}$$

$$= \frac{200 \times (0.6 - 0.2) \times 0.15}{0.4} = 30\ V$$

35. (b)

$P = i_{rms}^2 R = \left(\frac{i_{max}}{\sqrt{2}}\right)^2 R = \left(\frac{2}{\sqrt{2}}\right)^2 \times 10 = 20\ W$

36. (b)

(a) Output of AND gate is 0

(b) Output of NOR gate is 1

(c) Output of NAND gate is 0

(d) Output of OR gate is 0

37. (d) $\frac{1}{\alpha} = 1 + \frac{1}{\beta} = 1 + \frac{1}{19}$

$= \alpha = 0.95$

38. (a) Average life

$\tau = \frac{t_{1/2}}{\ln 2} = \frac{10}{0.693}$

$\simeq 14.4$hrs.

39. (c) $E = \frac{hc}{\lambda}$

$\Rightarrow \lambda = \frac{hc}{E} = \frac{1242eV - nm}{35 \times 10^3 eV}$

$\simeq 35 \times 10^{-3}$ nm

$= 35 \times 10^{-12}$ m

40. (c) Band gap is largest in insulators while it is smallest in conductors.

Chemistry

41. (a)

$a = 400$ pm

For Body centered unit cell;

$\sqrt{3}a = 4r$

$\therefore \frac{\sqrt{3}(400)}{4} = r\ r = 173.2pm$

42. (b) Fe, Co, Ni and CrO_2 are ferromagnetic in nature

43. (a)

$H_2SO_4 \rightarrow 2H^+_{(aq)} + SO^{2-}_{4(aq)}$

For $[H^+] = 0.1M$; the $p^H = 1$

Molarity of $H_2SO_4 = 0.05M$

$\therefore$ Normality of $H_2SO_4 = M_{H_2SO_4} \times n_f$

$= 0.05 \times 2$
$= 0.1$ N

44. (c)

$(CHCl_3 + H_3C - \overset{\overset{O}{\|}}{C} - CH_3)$

forms a non-ideal solution showing negative deviation

45. (b) Isotonic solution means $(\pi_1 = \pi_2)$

Isotonic presure for 6%w/v aqueous soltuion of area $(\pi_1) = icRT$

6 gms of area is present in 100 ml solution

$\therefore C = \frac{6}{60} \times \frac{1000}{100} = 1$

$\therefore \pi_1 = (1)(1)RT(\because$ i of area $= 1)$

$\pi_1 = RT$

$\therefore$ For 0.5 M NaCl solution, $i = 2$

so $\pi_2 = (2)(0.5RT)$

$\pi_2 = RT$

46. (c) Since the SRP value of $Ag^+/Ag = 0.80$ V

$\therefore$ aq solution of $CuSO_4$ can be stored in Ag as $E^0_{Cu^{2+}/cu} = 0.34$ V

47. (a) By Faraday's Ist law of electrolysis $m = zit$

$5.85 = \frac{E}{F}(i)(t)$

($\because$ E = Equivalent mass of Ni)

$E = \frac{58.5}{2}$ $5.85 = \frac{58.5}{2}\frac{(10)}{(96500)}(t)$

$\therefore t = 1930$ sec.

48. (a)

For the half cell; $Pt\left|H_{2(g)}\right|_{1\,bar}\left|HCl_{(aq)}\right. pH = 3$

$H_{2(g)} \rightarrow 2H^+_{(ag)} + 2e^-$ by Nernst equation

$$E_{cell} = E^\circ_{cell} - \frac{0.0591}{n}\log\frac{[H^+]^2}{p_{H_2}}$$

$$E_{cell} = 0 - \frac{0.0591}{2}\log\frac{(10^{-3})^2}{1} \quad [\therefore [H^+] = 10^{-3}M]$$

$$E_{cell} = -\frac{0.0591}{2}(-6)$$

$$E_{cell} = 0.177\ V$$

49. (d) Zincite is ZnO , so does not contain carbonate

50. (a) In the extraction of copper metal; the correct order is

Concentration → Roasting → Smelting → Bessimerisation

51. (b)

$2KMnO_4 + 16HCl \rightarrow 2MnCl_2 + 5Cl_2 + 2KCl + 8H_2O$

2 moles $KMnO_4$ produces 5 moles of Cl_2

1 mole of $KMnO_4$ will produce $\frac{5}{2}$ molles of Cl_2

$\therefore \frac{31.6}{316}$ moles of KMnO 4 will produce $\frac{1}{4}$ moles of Cl_2

$\therefore$ Mass of Cl_2 gas $= \frac{71}{4} = 17.75$gms.

52. (c) $XeOF_4$

Hybridization of Xe $= 5 + \frac{1}{2}[8 - 6]$

$= 5 + 1$
$= sp^3d^2$

Hence by the VSEPR theory, due to 5 bond pair & 1 lone pair of e^- The shape of $XeOF_4$ is square pyramidal

53. (b)

1 – Chloro but – 1 – ene $\Rightarrow$ $HC(Cl)=CH-CH_2-CH_3$

Hence the above is not an allylic halide but vinylic halide

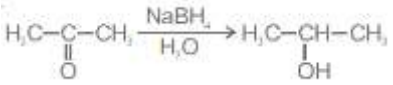
54. (a) On reaction of 2,2,2 - trichloro ethanal (Chloral) with $Ca(OH)_2$; chloroform ($CHCl_3$) is the main organic product obtained.

55. (d)

2, 2 – Dichloropentane $\Rightarrow$ $H_3C-C(Cl)_2-CH_2-CH_2-CH_3$

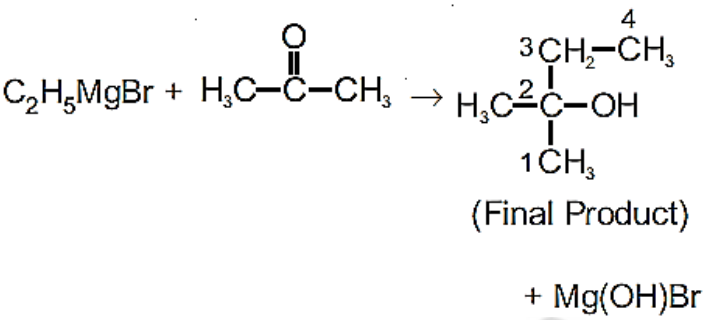
$\therefore$ The above compound is optically inactive

56. (b) In the reaction A, C, D the product formed is propan-1 -ol. whereas in the reaction – B



∴ Due to weaker force of attraction in Propan-2-ol; it has least boiling point.

57. (b)

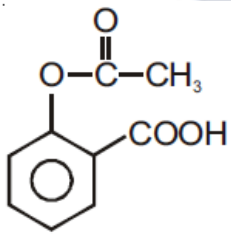


(Final Product)

+ Mg(OH)Br

∴ Final product formed is 2 -Methyl - butan-2-ol

58. (a)



Aspirin:

59. (b) Unit of rate constant (k) $= (\text{ conc })^{1-n}(s)^{-1}$

n = order of the reaction

The rate law of the reaction is

Rate $= K[\text{ Reactant }]^n$

For unit of Rate = Rate constant (k); n should be equal to 0

∴ Order is zero

60. (b) For 1st order reaction;

$$Kt = \ln\left(\frac{A_o}{A_t}\right)$$

$$K(20) = \ln\left(\frac{A_o}{0.25A_o}\right)$$

$$K(20) = \ln(4)$$

$$K = \frac{2\ln 2}{20} = \frac{0.693}{10} = 0.0693\ s^{-1}$$

61. (d) A Catalyst can,

(i) Increase the rate of reaction by decreasing the activation energy

(ii) Also increase the proportion of products per unit time.

(iii) Does not alter equilibrium established reaction. Hence does not alter equilibrium constant.

(iv) Does not alters the valueof ΔG and ΔH Hence the correct answer is (D)

62. (b) $Fe(OH)_3$ is a positively charged colloid. Hence under the influence of electricity these particles can migrate towards cathode.

63. (a) In production of sulphuric acid, in the presence of platinum catalyst, the impurity of copper decreases the efficiency of the catalyst. It is called catalytic poison.

64. (a) Magnatic moment $\mu = \sqrt{n(n+2)}BM$

where $n =$ no. of unpaired electrons

As the number of unpaired electrons increases, magnetic moment also increases.

In the given options.

$Ti^{+3} = [Ar]3d^1 4s^\circ; n = 1$

$Co^{+3} = [Ar]3\ d^6 4\ s^\circ; n = 4$

$Cr^{+3} = [Ar]3\ d^3 4\ s^\circ; n = 3$

$V^{+3} = [Ar]3\ d^2 4\ s^\circ; n = 2$

65. (c) Alloy is the combination of two or more metals.

According to Hume-Rothery ratio, metals which have

(i) Similar electronic structure in the valence shell

(ii) Similar crystal structure and

(iii) Difference in the radius should be less than 15% can form alloy.

Hence Fe, Ni, Cr - belongs to 3 d - series can form alloy.

66. (a) Incorrect option is (a) where

$K_4[Ni(CN)_4]sp^3$ Tetrahedran (Diamagnetic)

$K_2[Ni(CN)_4]dsp^2$ square planar (Diamagnetic)

$K_2[NiCl_4]sp^3$ Tetrahedran (Paramagnetic)

67. (d) The complex which produce least number of ions in aqueous solution will show least conductivity.

(a) $[Cr(H_2O)_6]Cl_3$; 4 ions

(b) $[Cr(H_2O)_4Cl_2]Cl$; 2 ions

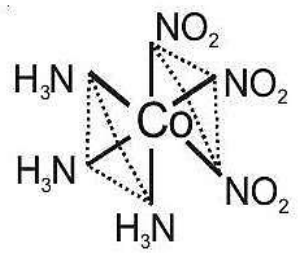
(c) $[Cr(H_2O)_5Cl_2]Cl_2$; 3 ions

(d) $[Cr(H_2O)_3Cl_3]$; No ions.

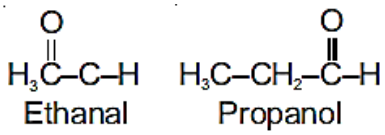
68. (b) Facial and Meridional isomersm shown by the complex

$[MA_3\ B_3]$ type

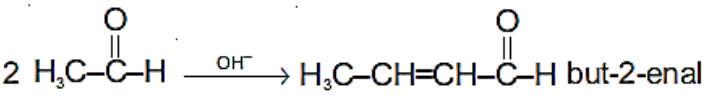
Ex:- $[Co(NH_3)_3(NO_2)_3]$

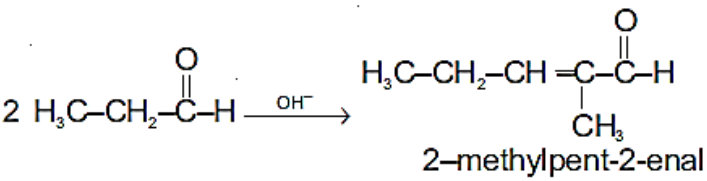


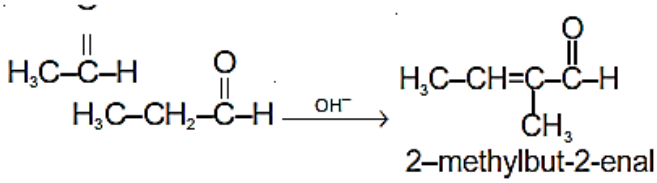
69. (c)

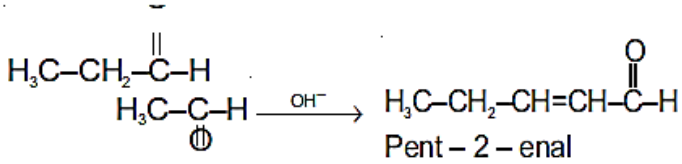


on crossed aldol condensation gives.



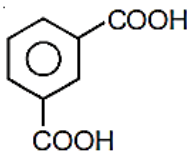


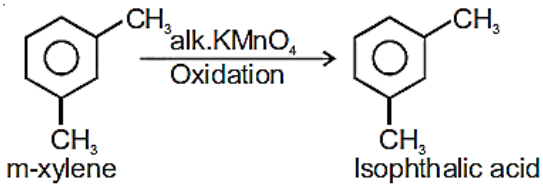




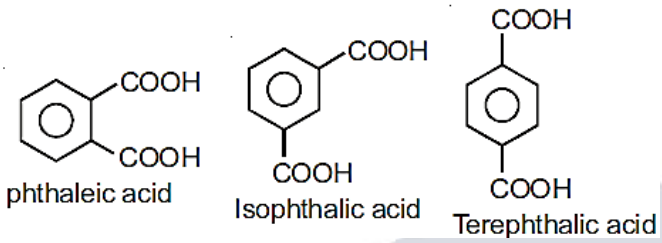
70. (c)

71. (b) Isophthalic acid is

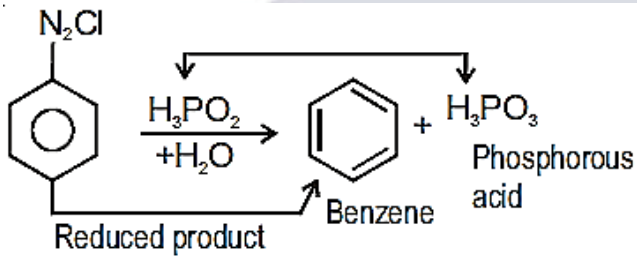




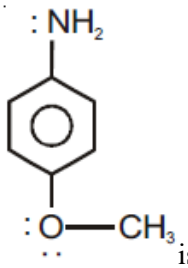
Note :



72. (d)



73. (b)

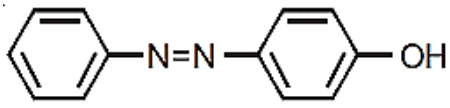


is most basic among the following

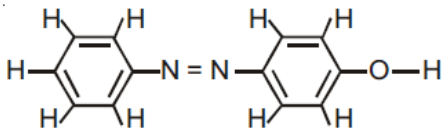
because of more pronounced +R effect $-\ddot{O}-CH_3$ of group.

Basic strength α EDG.

74. (a) Orange dye is



It is obtained by the reaction between B.D.C and phenol.



Total σ bonds = 26

Total π bonds = 7

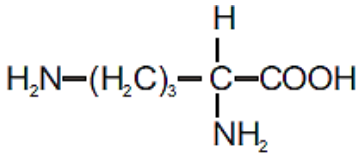
75. (d) [Guanine and adenine] are purine bases

Cytosine, Uracil, Thymine are pyrimidine bases.

76. (b) pH should be more for basic amino acids.

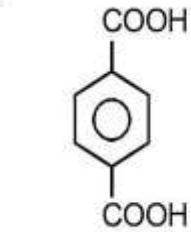
Lysine is basic amino acid.

Hence, its pH > 7.

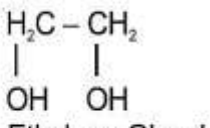


Lysine

77. (a) Terylene is the co-polymer of terephthalic acid and Ethylene glycol



Terephthalic Acid



Ethylene Glycol

78. (a) Buna −N

Butadiene + Prop - 2 - en - 1 - nitrile

$H_2C = CH - CH = CH_2 + H_2C = CH - C \equiv N$

79. (a)

Artificial sweetner - Alitame
Food Preservative - Sorbic acid
Anti- oxidant - Ascorbic acid
Food Colour - Caramel.

80. (a) Barbiturates can release from stress and anxiety.

Mathematics

81. (c)

$f(x) = x + \sqrt{1-x}\ 0 < x < 1$

$f'(x) = 1 - \frac{1}{2\sqrt{1-x}} = 0 \Rightarrow x = \frac{3}{4}$

$\therefore$ Interval of decrease is $(3/4,1)$

82. (b) $f'(x) = 2 - \frac{5}{x^4}$

$\Rightarrow f(x) = 2x + \frac{5}{3x^3} + c$

Now, $f(1) = \frac{14}{3}$

$\therefore c = 1$

$\Rightarrow f(x) = 2x + \frac{5}{3x^3} + 1$

$\therefore f(-1) = \frac{-8}{3}$

83. (d)

$\int \frac{\cos\alpha dx}{\sin x \cos(x-\alpha)}$

$= \int (\cot x + \tan(x-\alpha))dx$

$= \ln\left|\frac{1}{\cot x \cos\alpha + \sin\alpha}\right| + c$

$= -\ln(\cot x \cos\alpha + \sin\alpha) + c$

$= -\ln(\cot x + \tan\alpha) + c$

84. (a) $\int \frac{e^{\cot^{-1}x}}{1+x^2}(x^2 - x + 1)dx$

Let $\cot^{-1}x = t$

$\Rightarrow\ -\frac{1}{1+x^2}dx = dt$

$\int e^t(\cot t - \operatorname{cosec}^2 t)dt$

$e^t \cot t + c$

$xe^{\cot^{-1}x} + c$

85. (b) $\int_0^{\frac{\pi}{2}}(x - [\cos x])dx$

$\left[\frac{x^2}{2} - 0\right]_0^{\pi/2}$

$\frac{\pi^2}{8}$

86. (c)

$\int_{\log 2}^{a} \frac{e^x}{\sqrt{e^x - 1}} dx = 2$

$\Rightarrow \left[2\sqrt{e^x - 1}\right]_{\log 2}^{a} = 2$

$\Rightarrow 2\sqrt{e^a - 1} - 2 = 2$

$\Rightarrow 2\sqrt{e^a - 1} = 4$

$\Rightarrow \sqrt{e^a - 1} = 2$

$\Rightarrow e^a - 1 = 4$

$\Rightarrow e^a = 5$

$\Rightarrow a = \log_e 5$

87. (d)

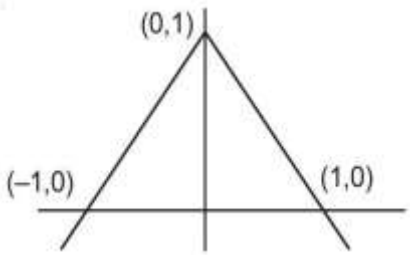
$\int_0^{\sqrt{2}} \sqrt{2 - x^2} dx$

$= \left[\frac{x}{2}\sqrt{2 - x^2} + \frac{2}{2}\sin^{-1}\left(\frac{x}{\sqrt{2}}\right)\right]_0^{\sqrt{2}}$

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

88. (b) Area bounded by rays

$|x| + y = 1$ and X-axis



$2\left(\frac{1}{2} \times 1 \times 1\right) = 1$

89. (b) Area bounded by $y^2 = 4ax$ and $x^2 = 4$ by

given by $\left|\frac{16ab}{3}\right| = 1$

$\therefore \left|\frac{16}{3} \times \frac{1}{4a} \times \frac{1}{4a}\right| = 1$

$a^2 = \frac{1}{3}$

$a = \frac{1}{\sqrt{3}}\ (a > 0)$

90. (a)

$2x\frac{dy}{dx} - y = 0$

$\frac{dy}{dy} = \frac{dx}{2x} \Rightarrow \int \frac{dy}{y} = \int \frac{dx}{2x}$

$\ln y = \ln \sqrt{x} + \ln c$

$y = c\sqrt{x}$ as $y(1) = 2$

$c = 2$

$y = 2\sqrt{x}$

$x = \frac{y^2}{4}$

∴ Parabola

91. (a) $\frac{dy}{dx} = \log x$

$y = x\log x - x + c$

as $y(1) = 3$

$3 = -1 + c$

$c = 4$

$y = x\log x - x + 4$

92. (c) $\frac{dp}{dt} = \frac{3}{100}p$

$\Rightarrow \int \frac{dp}{p} = \int \frac{3}{100}dt$

$\Rightarrow \ln p = \frac{3}{100}t + \ln c$

$\Rightarrow p = ce^{\frac{3}{100}t}$

93. (c) Let $a = x\hat{i} + y\hat{j} + z\hat{k}$;

as $x^2 + y^2 + z^2 = 1$

$|a \times i|^2 + |a \times j|^2 + |a \times k|^2$

$= y^2 + z^2 + x^2 + z^2 + x^2 + y^2$

$= 2(x^2 + y^2 + z^2) = 2$

94. (a) $(\bar{a} + 2\bar{b}) \cdot (5\vec{a} - 4\bar{b}) = 0$

$5 - 4(\bar{a} \cdot \bar{b}) + 10(\bar{a} \cdot \bar{b}) - 8 = 0$

$-3 + b(\bar{a} \cdot \bar{b}) = 0$

$\bar{a} \cdot \bar{b} = \frac{1}{2}$

$\cos\theta = \frac{1}{2}$

$\theta = \frac{\pi}{3}$

95. (c) $\cos\alpha = \frac{1}{2}; \cos\beta = -\frac{1}{\sqrt{2}}$

Now, $\cos^2\alpha + \cos^2\beta + \cos^2\gamma = 1$

$\frac{1}{2} + \frac{1}{2} + \cos^2\gamma = 1$

$\cos^2\gamma = 0$

$\gamma = 90°$

96. (a)

$\frac{x}{l} + \frac{y}{m} + \frac{z}{n} = 1$

As distance from origin is k ,

$\Rightarrow \frac{1}{\sqrt{\frac{1}{m^2} + \frac{1}{m^2} + \frac{1}{n^2}}} = k$

$\Rightarrow \frac{1}{l^2} + \frac{1}{m^2} + \frac{1}{n^2} = \frac{1}{k^2}$

97. (a) $\vec{r} = (3\hat{i} + \hat{j} - 2\hat{k}) + t(\hat{i} - \hat{j} - 2\hat{k})$

and

$\frac{x-4}{1} = \frac{y-0}{-1} = \frac{z+4}{-2}$

As direction ratio is same and (3, 1, -2) point is satisfying other line ∴ lines are coincident.

98. (b) Direction ratio normal to the plane is given by

$$\begin{vmatrix} i & j & k \\ 3 & 1 & 2 \\ 4 & 2 & 3 \end{vmatrix}$$

$= -\hat{i} - \hat{j} + 2\hat{k}$

and plane is passing through $(-3,0,2)$

$\Rightarrow \ -1(x+3) - 1(y-0) + 2(z-2) = 0$

$\Rightarrow \ -x - 3 - y + 2z - 4 = 0$

$\Rightarrow x + y - 2z + 7 = 0$

99. (c) Number of binary operations $= n^{n^2}$

$\Rightarrow 3^{3^2}$
$\Rightarrow 3^9$

100. (b)

$$f(n) = \begin{Bmatrix} \frac{n}{2}; & n \text{ - even} \\ -\left(\frac{n-1}{2}\right); & n\text{-odd} \end{Bmatrix}$$

when $n = 2,4,6,8$ ....

$f(n) = \{1,2,3$ ....

when $n = 1,3,5$ ...

$f(n) = \{0,-1,-2,-3 \ldots\}$

Function is one-one and onto

101. (c) $S = \{(3,3)(4,4)\}$

As $(5,5)$ is not present, therefor it is not reflexive But it is symmetric and transitive

102. (b) $\cot^{-1}\left(\frac{\sqrt{1+x^2}-1}{x}\right)$

put $(x = \tan\theta)$

$\cot^{-1}\left(\frac{\sec\theta - 1}{\tan\theta}\right)$

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

$= \cot^{-1}\left(\cot\left(\frac{\pi}{2} - \frac{\theta}{2}\right)\right)$

$= \frac{\pi}{2} - \frac{\theta}{2}$

$= \frac{\pi}{2} - \frac{1}{2}\tan^{-1}x$

103. (b) $\cos(2\tan^{-1}x) = \frac{1}{2}$

$2\tan^{-1} x = \pm\frac{\pi}{3}$

$\Rightarrow \tan^{-1} x = \pm\frac{\pi}{6}$

$\Rightarrow x = \pm\frac{1}{\sqrt{3}}$

104. **(c)** $\sin^{-1}(\cos(\sin^{-1} x)) + \cos^{-1}(\sin(\cos^{-1} x))$

$= \sin^{-1}\left(\cos\left(\frac{\pi}{2} - \cos^{-1} x\right)\right) + \cos^{-1}(\sin(\cos^{-1} x))$

$= \sin^{-1}(\sin(\cos^{-1} x)) + \cos^{-1}(\sin(\cos^{-1} x))$

$= \frac{\pi}{2} \left(\because \sin^{-1} x + \cos^{-1} x = \frac{\pi}{2}\right)$

105. **(c)** As $x^4 + y^4 + z^4 = 0$

$x = y = z = 0$

$\Rightarrow \begin{vmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{vmatrix} = 1$

106. **(a)**

$\begin{vmatrix} 10! & 11! & 12! \\ 11! & 12! & 13! \\ 12! & 13! & 14! \end{vmatrix}$

$10!\,11!\,12!\begin{vmatrix} 1 & 1 & 1 \\ 11 & 12 & 13 \\ 12\times 11 & 13\times 12 & 13\times 14 \end{vmatrix}$

$c_2 \to c_2 - c_1$ and $c_3 \to c_3 - c_1$

$10!\,11!\,12!\begin{vmatrix} 1 & 0 & 0 \\ 11 & 1 & 2 \\ 12\times 11 & 24 & 50 \end{vmatrix}$

$2(10!\,11!\,12!)$

107. **(a)**

$C_1 \to C_1 + C_2 + C_3$

$\begin{vmatrix} 2s & p & q \\ 2s & s+p & q \\ 2s & p & s+q \end{vmatrix}$

$R_3 \to R_3 - R_1$

$R_2 \to R_2 - R_1$

$\begin{vmatrix} 2s & p & q \\ 0 & s & 0 \\ 0 & 0 & s \end{vmatrix} = 2s^3$

108. **(a)** A s AB = BA, and $A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$

$\therefore$ By option B $= \begin{bmatrix} x & y \\ 0 & x \end{bmatrix}$

109. **(a)**

$$A = \begin{bmatrix} 3 & 3 & 3 \\ 3 & 3 & 3 \\ 3 & 3 & 3 \end{bmatrix}$$

$$A^3 = \begin{bmatrix} 243 & 243 & 243 \\ 243 & 243 & 243 \\ 243 & 243 & 243 \end{bmatrix}$$

$$A^3 = 81A$$

110. **(c)**

$$\frac{d}{dx}\log_{|x|} e$$

$$= \frac{d}{dx}(\log_e |x|)^{-1}$$

$$= -\frac{1}{x(\log|x|)^2}$$

111. **(a)**

$$\frac{d}{dx}\left(\tan^{-1}\left(\frac{1-x}{1+x}\right)\right)$$

$$= -\frac{1}{1+x^2}$$

112. **(d)** $x = at^2, y = 2at$

$$\frac{dx}{dy} = t$$

$$\Rightarrow \frac{d^2x}{dy^2} = \frac{d}{dt}(t) \times \frac{dt}{dy}$$

$$= 1 \times \frac{dt}{dy} = \frac{1}{2a}$$

113. **(c)**

$$\int x \cdot e^{x^2 \log 2} \cdot e^{x^2} dx$$

$$\int x \cdot 2^{x^2} \cdot e^{x^2} dx$$

$$\int x \cdot (2e)^{x^2} dx$$

$$x^2 = t$$

$$xdx = \frac{dt}{2}$$

$\frac{1}{2}\int (2e)^t dt$

$\frac{1}{2}\frac{(2e)^t}{\log 2e} + c$

$\frac{2^{x^2} \cdot e^{x^2}}{2(\log 2 + 1)} + c$

114. (b)

$\int \left(\frac{1}{x-3} - \frac{1}{x^2 3x}\right) dx$

$\frac{2}{3}\int \frac{1}{x-3} dx + \frac{1}{3}\int \frac{1}{x} dx$

$\frac{2}{3}\ln(x-3) + \frac{1}{3}\ln x + c$

$\frac{2}{3}\ln(\sqrt{x}(x-3)) + c$

115. (d) Mean $(\bar{x}) = \sum x_i p(x_i)$

$= \frac{1}{6} + \frac{2}{3} + 1 + \frac{2}{3} = \frac{5}{2}$

$\therefore$ Mean of $f(x) = 3\left(\frac{5}{2}\right) + 2$

$= \frac{19}{2}$

116. (b) Variance $= npq = 6 \times 0.3 \times 0.7 = 1.26$

117. (b)

$P(A) = \frac{4}{5};\ P(\bar{A}) = \frac{1}{5}$

$P(B) = \frac{3}{5};\ P(\bar{B}) = \frac{2}{5}$

required probability $= \frac{4}{5} \times \frac{2}{5} + \frac{3}{5} \times \frac{1}{5} + \frac{4}{5} \times \frac{3}{5}$

$= \frac{23}{25}$

118. (d) $15p + 15q = 20q$

$3p = q$

119. (c)

$\Delta x = -\frac{1}{5x^{4/5}} \times .001$

Here $x = 243$

$\therefore \Delta x = -\frac{1}{405000}$

Approximate value $= \frac{1214999}{405000}$

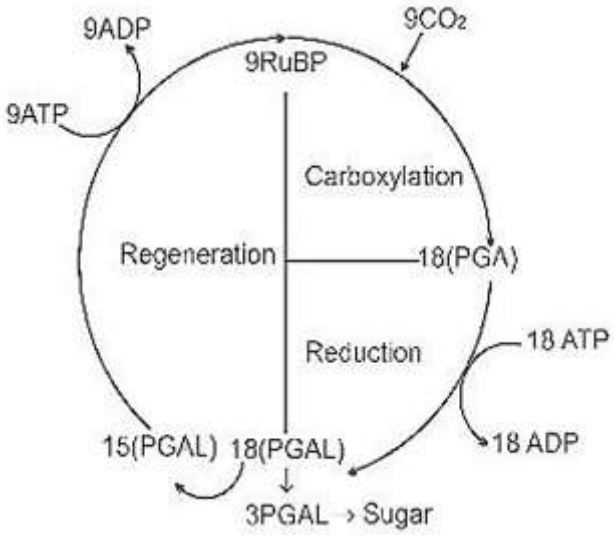
120. **(d)** Length of subtangent $= y_1 \cot\theta$

$= y \times \frac{1}{25y} = \frac{1}{25}$

$\therefore$ constant

Biology

121. **(b)**
122. **(c)**
123. **(a)**
124. **(a)**
125. **(a)**
126. **(a)**
127. **(c)**
128. **(a)**
129. **(c)**
130. **(c)**
131. **(b)**
132. **(a)**
133. **(a)**
134. **(b)**
135. **(d)**
136. **(a)**
137. **(c)**
138. **(a)**
139. **(c)**
140. **(d)**
141. **(a)**
142. **(b)**
143. **(a)**
144. **(a)**
145. **(a)**
146. **(c)**
147. **(c)**



148. **(a)**
149. **(a)**
150. **(b)** Peripheral is Extrinsic protein.
151. **(a)**
152. **(b)**
153. **(d)**
154. **(b)**
155. **(a)**
156. **(d)**
157. **(c)**
158. **(c)** Klinefelter's syndrome $-2A + XXY$

Trisomy is $2n + 1$

159. **(b)** AaBb × aabb Test cross

	↓ ab
AB	AaBb
Ab	Aabb
aB	aaBb
ab	aabb

Ratio $= 1:1:1:1$

160. **(c)**