1. (b)

$B = \frac{\mu_0 i}{2\pi r}$

$\Rightarrow B \propto \frac{1}{r}$

2. (d)

$\lambda = \frac{h}{P}$

λ is same for both hence P is same for both

3. (a) Photo current is independent of frequency of incident radiation.

4. (a) According to Lenz's law

5. (a) $\phi = B_x A = 5 \times 4 = 20$ Wb

Area, $A = l \times b = 2 \times 2 = 4\ m^2$

6. (d) AC voltage and AC current

7. (c) $V_{rms} = \frac{V_0}{\sqrt{2}} = \frac{311}{1.414} = 220$

$\omega = 314$

$2\pi n = 314$

$n = \frac{314}{2 \times 3.14} = 50$ Hz

8. (a) $V = 100$ V

$X_L = 24\Omega$

$X_C = 16\Omega$

$R = 6\Omega$

$I = \frac{V}{Z} = \frac{100}{\sqrt{R^2 + (X_L - X_C)^2}}$

$I = \frac{100}{\sqrt{6^2 + 8^2}} = \frac{100}{10} = 10$ A

$V_L = iX_L = 10 \times 24 = 240$ V

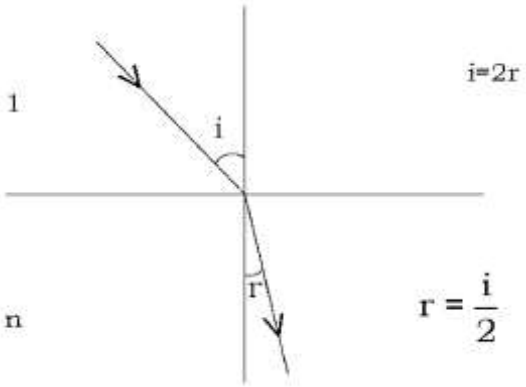
$V_C = iX_C = 10 \times 16 = 160$ V

Voltage across L and C is

$V^1 = 240 - 160 = 80$ volts

9. (a) Conceptual

10. (b)



$1 \sin i = n \sin \frac{i}{2}$

$2 \sin \frac{i}{2} \cos \frac{i}{2} = n \sin \frac{i}{2}$

$\cos \frac{i}{2} = \frac{n}{2}$

$\frac{i}{2} = \cos^{-1}\left(\frac{n}{2}\right)$

$i = 2\cos^{-1}\left(\frac{n}{2}\right)$

11. (d) Power of L_1 is $\frac{1}{f} = P$

Power of L_2 and L_3 is $\frac{P}{2}$

12. (b) Real, enlarged image

13. (d) $r' = A - (10 + t^2)$

$r' = 50 - 10 - t^2$

$r' = 40 - t^2$

14. (a) It converts as spherical wave front and converges towards focus.

15. (a) Total energy remains same.

16. (b) $r_n = r\frac{n^2}{Z} = r\frac{2^2}{1} = 4r$

17. (d) Isotopes (Z = same, same element) $= {}_1H^1, {}_1H^2$

Isobars (A = same, different elements)

$= {}_3Li^7, {}_4Be^7$ Isotones (n = A − Z = same, different elements) $= {}_8O^{18}, {}_9F^{19}$

18. (c) Conceptual

19. (d) For Metals or conductors, Conductivity is high $\sigma = 10^2$ to $10^8 Sm^{-1}$

Resistivity is low $\rho = 10^{-2}$ to $10^{-8}\Omega$ m

20. (d) In n - type semiconductor, donor energy level lies just below the bottom of conduction band.

21. (c). $I = \frac{V}{R_{eff}} = \frac{3}{70+30} = 0.03$ A

22. (a) $n = \frac{R_3 - R_1}{R_3 - R_2} = \frac{8.123 - 5.123}{8.123 - 6.123} = \frac{3}{2} = 1.5$

23. (c) $G = \frac{RS}{R-S} = \frac{5200 \times 90}{5200 - 90} = 91.5\Omega$

24. (a)

$\eta = \frac{2}{9}\frac{r^2 g(\rho - \sigma)}{V}$

$\eta = \frac{2}{9} \times \frac{3 \times 10^{-6} \times 10 \times 7000}{1/3}$

$\eta = 0.14$

25. (c) Dimensional analysis is not applicable for trigonometric and exponential functions

26. (c) Case (i) $x_1 = \frac{1}{2}gt_0^2$

Case (ii) $x_2 = \frac{1}{2}\, g(t_0 - \Delta t)^2$

Given $x_1 - x_2 = H = \frac{1}{2}gt_0^2 - \frac{1}{2}\, g(t_0 - \Delta t)^2$

$\Rightarrow t_0 = \frac{H}{g\Delta t} + \frac{\Delta t}{2}$

27. (b) Horizontal component of velocity remains constant.

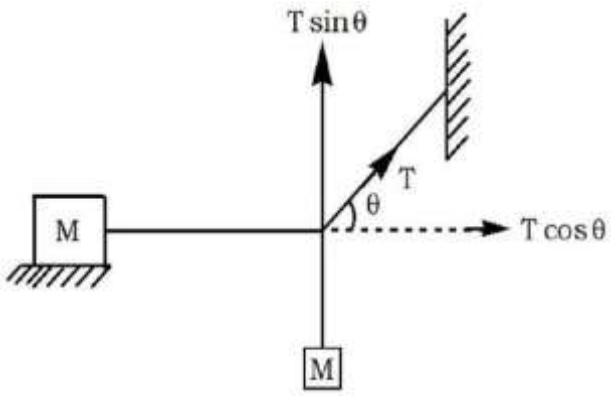
28. (c) $(x-2)^2 + y^2 = 25$

Compare above equation with equation of circle $x^2 + y^2 = r^2$ then $r = 5$

$\therefore a = \frac{v^2}{r} = \frac{2^2}{5} = 0.8$

When particle attains lowest ' y ' co- ordinate, acceleration particle is along x axis

29. (a)



$T\sin\theta = Mg$
$T\cos\theta = \mu Mg$
$\frac{T\cos\theta}{T\sin\theta} = \frac{\mu Mg}{Mg} = \mu$
$\cot\theta = \mu$

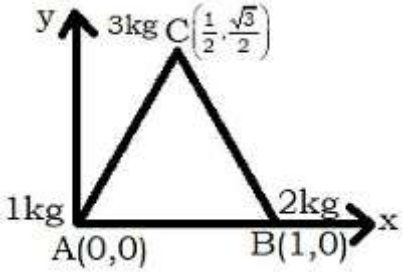
30. (d) $\mu_s = 0.4$
$\mu_k = 0.25$
Acceleration $= \frac{Y_2 - Y_1}{X_2 - X_1} = \frac{20}{3}$
$F = ma + \mu mg$
$m = \frac{F}{\mu g + a} = 2.18 \simeq 2.2$ kg

31. (d) $V = kx^{\frac{3}{2}}$
$W = \Delta K.E = \frac{1}{2}MV^2$
$W = \frac{1}{2}M \cdot K^2x^3$
$= \frac{1}{2} \times 0.25 \times 4[2^3]$
$= 0.5 \times 8 = 4$ J

32. (c) Conceptual

33. (a) $x_{cm} = \frac{m_1x_1 + m_2x_2 + m_3x_3}{m_1 + m_2 + m_3} = \frac{7}{12}$ m

$$y_{cm} = \frac{m_1y_1 + m_2y_2 + m_3y_3}{m_1 + m_2 + m_3} = \frac{3\sqrt{3}}{12} \text{ m}$$



34. (d) $r_1\omega_1 = r_2\omega_2$
$r_1\alpha_1 = r_2\alpha_2$
$10 = 4\alpha_1$
$\alpha_1 = \frac{5}{2}$
$\alpha_2 = \frac{5}{3}$ radian $/\sec^2$
$\tau_2 = 20 \times \frac{5}{3} = \frac{100}{3}$ N − m

35. (b)

36. (a) $E = -\frac{GMm}{2(R+h)}$

37. (d) $Y = \frac{F\ell}{Ae}$

$e \propto \frac{\ell}{A} \propto \frac{\ell}{D^2} \Rightarrow \frac{e_1}{e_2} = \frac{\ell_1}{\ell_2}\frac{D_2^2}{D_1^2} = \frac{1}{3} \times \frac{4}{1} = 4:3$

38. (c) $A_1 V_1 = A_2 V_2$

$10 \times 1 = 5 \times V_2$

$V_2 = 2\ m/s$

$P_1 - P_2 = \frac{1}{2}\rho(V_2^2 - V_1^2)$

$P_2 = P_1 - \frac{1}{2}\rho(V_2^2 - V_1^2)$

$P_2 = 2000 - \frac{1}{2} \times 1000 \times (2^2 - 1^2)$

$P_2 = 2000 - 1500 = 500\ Pa$

39. (a) $\theta - 0 + \theta - 90 + \theta - 90 = 0$

$3\theta - 180 = 0$

$\theta = 60°C$

40. (b) ΔU is independent of the path

$\Delta U_1 = \Delta U_2$

$Q_1 - w_1 = Q_2 - w_2$

41. (c) $T_1 = 27 + 273 = 300\ K$

$E_1 = E$

$T_2 = 327 + 273 = 600\ K$

$E_2 = ?$

$KE \propto T$

$\Rightarrow \frac{E_1}{E_2} = \frac{T_1}{T_2} = \frac{300}{600} = \frac{1}{2}$

$\therefore E_2 = 2E_1$

42. (b) $PE = KE$

$\frac{1}{2}m\omega^2 x^2 = \frac{1}{2}m\omega^2(A^2 - x^2)$

$2x^2 = A^2$

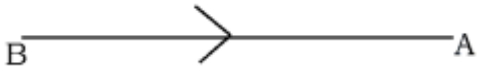
$x = \frac{A}{\sqrt{2}}$

43. (b)

44. (b) From Gauss law

45. (d). $\phi = \frac{-q}{\varepsilon_0}$ (flux is inwards)

46. (a)



$W_{B\to A} = (V_A - V_B)q$

$= (-3 - 5) \times 5 \times 10^{-3}$

$= -0.04\ J$

47. (a) $E_{in} = 0$

$E_{out}\ \alpha \frac{1}{r}$

48. (d) $U = -PE\cos\theta$

(a) $\theta = 180° \Rightarrow \cos 180° = -1 \Rightarrow U = PE$

(b) $\theta = 120° \Rightarrow \cos 120° = -\left(\frac{1}{2}\right) \Rightarrow U = \frac{PE}{2}$

(c) $\theta = 90° \Rightarrow \cos 90° = 0 \Rightarrow U = 0$

49. (a)

Properties of equipotential surface

$\Delta v = 0$

$W = (\Delta v)q = 0$

50.(d) Gauss's law states that electric flux associated with any closed surface is equal to $\frac{1}{\varepsilon_0}$ times of charge enclosed by that surface

51. (b)

$R_{eq} = R + r = 3.9 + 0.1 = 4\Omega$

$i = \frac{E}{R_eq} = \frac{2}{4} = 0.5\Omega$

$V = E - ir$

$= 2 - 0.5 \times 0.1$

$= 1.95\ V$

52. (d)

$E_{equi} = \frac{E_1 r_2 + E_2 r_1}{r_1 + r_2}$

Let $E_1 = 10\ V, r_1 = 10\Omega$

Let $E_2 = 20\ V, r_2 = 20\Omega$

$E_{equi} = \frac{10(20) + 20(10)}{10 + 20} = \frac{400}{30} = 13.3\ V$

53. (d)

54. (c)

55. (c). $R = \frac{\rho \ell}{A} \left[\therefore A = \frac{\pi d^2}{4}\right]$

$R = \frac{4\rho\ell}{\pi\, d^2}$

$R \propto \frac{1}{d^2}$

56. (b) $\frac{F}{\ell} = \frac{\mu_0 i_1 i_2}{2\pi r}$

$\frac{F}{\ell} = \frac{\mu_0 I^2}{2\pi r}$ [Repel each other]

57. (b) $B = \mu_0 ni$

$B = 4\pi \times 10^{-7} \times 5 \times 1000 \times 7$

$B = 4.396 \times 10^{-2} T$

58.(c) The shunt of milliammeter will be of larger resistance, because a large part of main current will pass through the coil of the galvanometer which will work as small range ammeter.

59.(d) susceptibility is small and negative

60. (b) A straight current carrying conductor has a circular magnetic field lines around it

Chemistry

61. (c)

62. (c)

63. (c) $Cu \rightarrow 4\ s^1 3\ d^{10}$

$Ag \rightarrow 5\ s^1 4\ d^{10}$

64. (c)

65. (d)

66. (b)

67. (b)

68. (a)

69. (c)

70. (a)

71. (b) HNO_3 is an oxidising agent

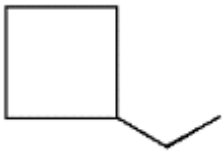
72. (a) Al^{3+} ppt as $Al(OH)_3$ in presence of NH_4Cl and NH_4OH.

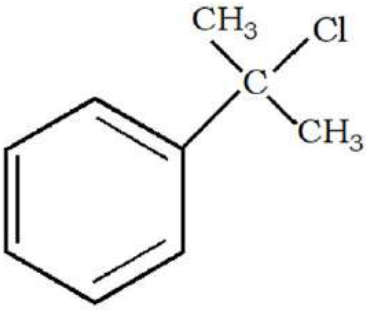
73. (a)

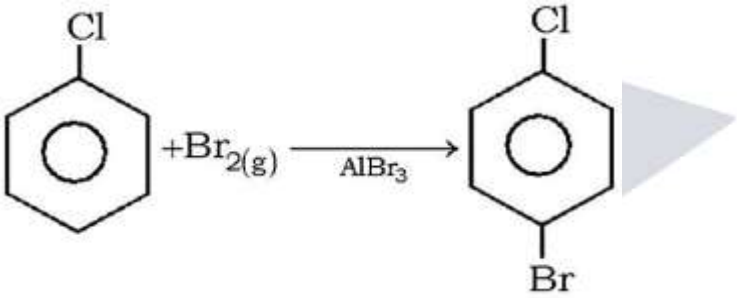
74. **(c)**

75. **(d)**

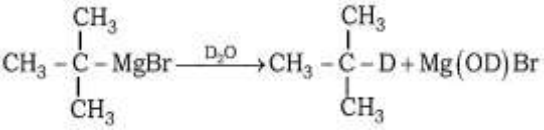
76. **(b)**

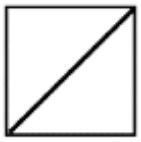
77. **(b)**  is not an isomer of hexane because, it is a ring chain isomer of hexene.

78. **(a)**  is a 3^0 benzyl chloride

79. **(b)** 

is an example for Electrophilic substitution reaction

80. **(c)** 

81. **(b)**  Intra molecular Wurtz reaction takes place and forms.

82. **(d)** Diethyl Ether (inter molecular dehydration takes place)

$2C_2H_5 - OH \xrightarrow{413\ K} C_2H_5 - O - C_2H_5 + H_2O$

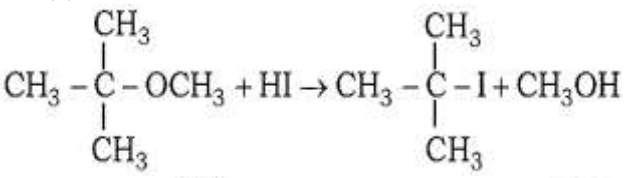
83. **(d)** Bromine water test

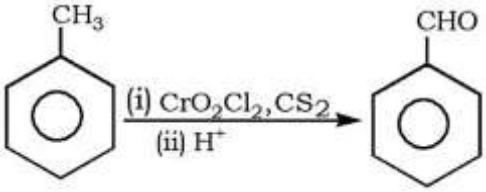
Phenol $+Br_2$ water → white ppt,

Alcohol $+Br_2$ water → No reaction

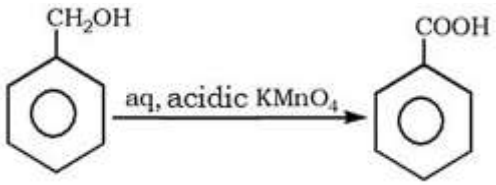
84. **(d)**

85. **(a)**



86. **(d)** 

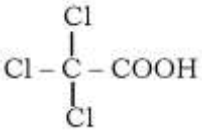
87. (a) $R-COOR^1 \xrightarrow[H_3O^+]{\text{DIBAL-H}} R-CHO + R^1-OH$



88. (d) Reactivity order towards Nucleophilic addition reactions

$CH_3-CHO > CH_3-CO-CH_3 > CH_3-CO-C_2H_5$

89. (b) (Trichloroacetic acid)



90. (c) Chloroform and Alc. KOH

91. (b) $R-C\equiv N + H_2O \xrightarrow{H^+} RCOOH$

92. (c)

93. (d)

K	L	M	N
S	S, P	S, P, d	S, P, d, f
1	1 + 3	1 + 3 + 5	1 + 3 + 5 + 7

Total number of orbitals in N^{th} shell $= 16$

(Or)

Total number of orbitals in the given shell $= n^2$ $n = 4$ then $n^2 = 16$

94. (c)

$$\Delta v \cdot \Delta x = \frac{h}{4\pi m}$$

$$= \frac{6.626 \times 10^{-34}}{4 \times 3.14 \times 10^{-6}}$$

$$= \frac{6.626 \times 10^{-28}}{12.56}$$

$$= 0.527 \times 10^{-28}$$

$$= 5.27 \times 10^{-29}\ m^2\ s^{-1}$$

95.(c)

$w = +ve, q = 0$

$\Delta U = w + q$

$\Delta U = w$

96.(b) $\Delta H - \Delta U = \Delta ngRT$ $(\Delta ng = 0)$

$\Delta H - \Delta U = 0$

$\Delta H = \Delta U$

97. (a)

98. (b)

99.(d) increasing the concentration of CO and decreasing the concentration of CH_4.

100. (a) $A + B \rightleftharpoons C + D$

initial	1	1	1	1
At eqb	$1-x$	$1-x$	$1+x$	$1+x$

$$K_c = \frac{[C][D]}{[A][B]}$$

$$100 = \frac{(1+x)(1+x)}{(1-x)(1-x)}$$

$$\Rightarrow 10^2 = \left[\frac{(1+x)}{(1-x)}\right]^2$$

$\Rightarrow 10(1-x) = 1+x$

On solving, we get $x = 0.818$

$\therefore [D] = 1 + x = 1.818$

101. (c)

$m = 0.1$

$\Delta T_b \propto$ concentration

i.e., lowest boiling elevation shown by solution with lowest concentration

102. (b) Solubility of gas in liquid decreases with temperature.

103. (d)

$w_2 = 180gm$

$M_2 = 180gm$

$w_1 = 1\ kg$

$K_b = 0.52\ K \cdot\ kg \cdot\ mol^{-1}$

$T_b^0 = 373.15\ K$

$\Delta T_b = K_b\ m$

$= 0.52\left[\frac{180}{180} \times \frac{1000}{1000}\right] = 0.52$

$T_b^s = T_b^0 + 0.52$

$= 373.15 + 0.52$

$= 373.67k$

104. (b,d)

$P_{N_2} = 0.987$ bar

$K_H = 76.48$ K. bar. $= 76.48 \times 10^3$ bar

Henry's law $P = K_H X$

$$X = \frac{P}{K_H} = \frac{0.987}{76.48 \times 10^3}$$

$$\frac{n_{N_2}}{n_{N_2} + n_{water}} = 0.0129 \times 10^{-3}$$

$n_{N_2} \lll n_{water}$

Hence

$n_{N_2} = n_{water} \times 0.0129 \times 10^{-3}$

$= \frac{1000}{18} \times 0.0129 \times 10^{-3}$

$= 0.000716$

$= 0.716 \times 10^{-3}$

105. (b)

In a galvanic cell, Anode is negative terminal

Cathode is positive terminal

If $E_{cell} < 0$, then it is non-spontaneous reaction

106. (a)

107. (c)

$$E_{Al^{3+}/Al} = E^0_{Al^{3+}/Al} - \frac{0.059}{3}\log\frac{1}{[Al^{3+}]}$$

$\therefore E_{Al^{3+}/Al} \alpha [Al^{3+}]$

108. (a)

$Ag^+ \Rightarrow 96500 C mol^{-1}$

$Mg^{+2} = 2 \times 96500$

$= 193000 C mol^{-1}$

$Al^{+3} \Rightarrow 3 \times 96500$

298500

$Ti^{+4} = 4 \times 965000$

$= 3866000$

109. (a) Catalyst decrease the activation energy of the reaction and increase the rate of

110. (b) 0.2 M

$\xrightarrow{20\text{ sec}} 0.1\text{M} \xrightarrow{20\text{ sec}} 0.05\text{M} \xrightarrow{20\text{ sec}}$
$\rightarrow 0.025\text{M} \overset{20\text{sec}}{\rightarrow} 0.0125\text{M}$
Total time $= 4 \times 20\text{sec} = 80\text{sec}$ concentration of reactant
Amount of substance left $= 0.0125\text{M}$

111. **(d)** $\Delta H = (E_a)_f - (E_a)_b$
$90 = 215 - (\text{E}_\text{a})_\text{b}$
$(\text{E}_\text{a})_\text{b} = 215 - 90 = 125\text{KJ}$

112. **(c)** Rate of production of $\frac{\text{d}[\text{NO}_2]}{\text{dt}} = ?$
$\Rightarrow -\frac{1}{2}\frac{\text{d}[\text{N}_2\text{O}_5]}{\text{dt}} = +\frac{1}{4}\frac{\text{d}[\text{NO}_2]}{\text{dt}}$
$\Rightarrow \frac{\text{d}[\text{NO}_2]}{\text{dt}} = \frac{4}{2}\frac{\text{d}[\text{N}_2\text{O}_5]}{\text{dt}} \Rightarrow \frac{4}{2} \times \frac{2-1.4}{300}$
$= 4 \times 10^{-3}$ mole.lit. min^{-1}

113. **(d)** Mole fraction and mass percent (w/w) has no units because both are mass ratios

114. **(a)**

115. **(b)**

116. **(a)** Hybridisation changes from sp^2 to sp^3

117. **(d)**

Molecule/ion	Bond order
(a) $\text{NO}(15\text{e}^-)$	2.5
(b) $\text{CO}(14\text{e}^-)$	3.0
(c) $\text{O}_2^-(17\text{e}^-)$	1.5
(d) $\text{O}_2(16\text{e}^-)$	2.0

118. **(b)** $X = +3$
$\text{Y} = -1$
Compound formula XY_3 covalent

119. **(b)**
$\text{CH}_4 + 2\text{O}_2 \overset{\triangle}{\rightarrow} \text{CO}_2 + 2\text{H}_2\text{O}$ – combination reaction
$2\text{H}_2\text{O} \overset{\Delta}{\rightarrow} 2\text{H}_2 + \text{O}_2$ – Decomposition reaction
$\text{Cl}_2 + 2\text{Br}^- \rightarrow 2\text{Cl}^- + \text{Br}_2$ – Displacement reaction
$2\text{H}_2\text{O}_2 \rightarrow 2\text{H}_2\text{O} + \text{O}_2$ – Disproportionation reaction

120. **(d)** $\text{SC}^{3+}, \text{Zn}^{2+}$ - are colourless due to absence of unpaired electrons

Mathematics

121. **(d)** Statement-I: $3x + 8 < 17$ and $2x + 8 \geq 12$
$\Rightarrow \text{x} < 3$ and $\text{x} \geq 2$
∴ Statement-I is true
Statement-II: $3\text{x} + 8 < 17$ and $2\text{x} + 8 \geq 12$
$\Rightarrow \text{x} < 3$ and $\text{x} \geq 2$
$\Rightarrow \text{x} \in [2,3)$
∴ Statement-II is false

122. **(a)**
Numbers end with $0 = 3! = 6$
Numbers end with $2 = 2 \times 2 \times 1 \times 1 = 4$
Total numbers $= 6 + 4 = 10$

123. **(a)**
Number of sides, $\text{n} = 8$
Number of diagonals $= \frac{\text{n(n-3)}}{2} = \frac{8(8-3)}{2}$
$= 4 \times 5 = 20$

124. **(b)** $3\text{n} + 1 = 22 \Rightarrow \text{n} = \frac{21}{3} = 7$

125. **(a)**

$(ar^9)^2 = (ar^3)(ar^{15})$
$\Rightarrow y^2 = xz$
$y = \sqrt{xz}$

126. (d)

$A^2 = A$
$A^3 = A^2$
$(I - A)^3 = I - A^3 - 3A + 3A^2$
$= 1 - A^2 - 3A^2 + 3A^2$
$= I - A$

127. (b)

$AB = I, O(B) = 3 \times 4$
To defined matrix AB ,
No. of columns in A is equal to No.of rows in B .
$\because$ AB is identify matrix
$\therefore O(A) = 4 \times 3$

128. (a) A square matrix which contains all elements are zero except diagonal element.

129. (d) $A^2 = \begin{bmatrix} 2 & 2 \\ 2 & 2 \end{bmatrix} = 2^1 A^1$

$A^3 = 2^2 . A^1$
$A^6 = 2^5 A^1$
$KA^1 = 2^5 . A^1$
$K = 32$

130. (a)

$|A|^3 = 125 \Rightarrow |A| = 5$
$|A| = K^2 - 4$
$5 = K^2 - 4 \Rightarrow K = \pm 3$

131. (d) $A^{-1}(A^2 - 5A + 7I) = A^{-1}(0)$
$A - 5A^{-1}A + 7A^{-1}I = 0$
$A^{-1} = \frac{1}{7}(5I - A)$

132. (c) $|A| = 3$

$|3\ A^{-1}| = (3)^3 |\ A|^{-1} = 27 \frac{1}{|\ A|} = 27\left(\frac{1}{3}\right) = 9$

133. (a) $B = \text{adj}A$
$|B| = |A|$
$\alpha - 3 = 2$
$\therefore \alpha = 5$

134. (a) $|A| = \begin{vmatrix} 4 & 6 \\ 8 & 12 \end{vmatrix} = 48 - 48 = 0$

$(\text{adj}A)B = \begin{bmatrix} 12 & -6 \\ -8 & 4 \end{bmatrix} \begin{bmatrix} 5 \\ 10 \end{bmatrix} = \begin{bmatrix} 60 - 60 \\ -40 + 40 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix} = 0$

135. (b) $(\vec{a} + \lambda\vec{b}) \cdot \vec{c} = 0$
$((1 + \lambda)\hat{\imath} + (2 - \lambda)\hat{\jmath} + (1 + 4\lambda)\hat{k}) \cdot (\hat{\imath} + \hat{\jmath} + \hat{k}) = 0$
$1 + \lambda + 2 - \lambda + 1 + 4\lambda = 0$
$4\lambda = -4 \Rightarrow \lambda = -1$

136. (c)

$|\vec{a} \times \vec{b}|^2 + (\vec{a} \cdot \vec{b})^2 = |\vec{a}|^2 |\vec{b}|^2$
$|\vec{a} \times \vec{b}|^2 = |\vec{a}|^2 |\vec{b}|^2 - (\vec{a} \cdot \vec{b})^2$
$= (100)(4) - 144 = 400 - 144 = 256$
$|\vec{a} \times \vec{b}| = 16$

137. (d) If $\bar{a} \cdot \bar{b} = 0$ then $|\vec{a}| = 0$ or $|\vec{b}| = 0$ or $\theta = \frac{\pi}{2}$
If $\bar{a} \times \bar{b} = 0$ then $|\vec{a}| = 0$ or $|\vec{b}| = 0$ or $\theta = 0$ or π

138. (d)

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

$\cos^2 90^0 + \cos^2 60^0 + \cos^2\theta = 1$

$0 + \frac{1}{4} + \cos^2\theta = 1$

$\cos^2\theta = \frac{3}{4}$

$\cos\theta = \frac{\sqrt{3}}{2} \Rightarrow \theta = \frac{\pi}{6}$

139. **(a)** Using option 1: Line passes through (0,1,2) and since lines are perpendicular

$a_1a_2 + b_1\,b_2 + c_1c_2$

$= (2)(-3) + (3)(4) + (-2)(3)$

$= -6 + 12 - 6 = 0$

140. **(a)** $m_1 = -\frac{1}{6}$ then $m_2 = 6$

Equation of line passing through $(-1,-3)$ and perpendicular to given line is $y + 3 = 6(x + 1)$

For x intercept put $y = 0$ then $x = \frac{-1}{2}$

141. **(b)**

$\frac{x^2}{12} + \frac{y^2}{4} = 1, a^2 = 12,\ b^2 = 4, a > b$

Then LLR $= \frac{2\,b^2}{a} = \frac{2.4}{\sqrt{12}} = \frac{4}{\sqrt{3}}$

142. **(a)**

$\lim_{x\to 1} \frac{x^4 - \sqrt{x}}{\sqrt{x} - 1} = \lim_{x\to 1} \frac{4x^3 - \frac{1}{2\sqrt{x}}}{\frac{1}{2\sqrt{x}} - 0}$ (by L'Hosptal Rule)

$= \frac{4 - \frac{1}{2}}{\frac{1}{2}} = 7$

143. **(b)** $\frac{dy}{dx} = \frac{(1+\sin x)(-\sin x) - (\cos x)(\cos x)}{(1+\sin x)^2} = \frac{-1-\sin x}{(1+\sin x)^2} = \frac{-1}{1+\sin x}$

Also

$y = \frac{\cos x}{1+\sin x} = \frac{\cos^2\frac{x}{2} - \sin^2\frac{x}{2}}{\left(\cos\frac{x}{2} + \sin\frac{x}{2}\right)^2} = \frac{\cos\frac{x}{2} - \sin\frac{x}{2}}{\cos\frac{x}{2} + \sin\frac{x}{2}} = \tan\left(\frac{\pi}{4} - \frac{x}{2}\right)$

Then $\frac{dy}{dx} = \sec^2\left(\frac{\pi}{4} - \frac{x}{2}\right)\left(-\frac{1}{2}\right)$

144. **(c)** $x|x| = \begin{cases} -x^2; & x < 0 \\ x^2; & x \geq 0 \end{cases}$ is differentiable in $(-1,1)$ $\sqrt{|x|}$ is not differentiable at $x = 0$

$x + [x] = \begin{cases} x - 1; & -1 \leq x < 0 \\ x; & 0 \leq x < 1 \end{cases}$ is strictly

increasing $|x - 1| + |x + 1|$ is continuous in $(-1,1)$

145. **(b)**

LHL = RHL

$\Rightarrow e^0 + 0 = b(-1)^2$

$\Rightarrow 1 = b$

LHD = RHD

$\Rightarrow e^x + a = b(2(x - 1))$

$\Rightarrow 1 + a = -2\,b \Rightarrow a = -3$

146. **(a)** LHL $= Lt_{x\to 0^-} \frac{e^{\frac{1}{x}} - 1}{e^{\frac{1}{x}} + 1} = Lt_{x\to(0-h)} \frac{e^{\frac{1}{-h}} - 1}{e^{\frac{1}{-h}} + 1} = \frac{-1}{1} = -1$

RHL $= Lt_{x\to 0^+} \frac{e^{\frac{1}{x}} - 1}{e^{\frac{1}{x}} + 1} = Lt_{x\to(0+h)} \frac{e^{\frac{1}{h}} - 1}{e^{\frac{1}{h}} + 1} = 1$ (by L'Hosptal Rule)

LHL $\neq$ RHL then $f(x)$ is not continuous at $x = 0$

147. **(c)** $\frac{dy}{dx} = \frac{\left(\frac{dy}{dt}\right)}{\left(\frac{dx}{dt}\right)} = \frac{a.3\sin^2 t \times \cos t}{a.3\cos^2 t \times (-\sin t)} = -\tan(t)$

At $t = \frac{3\pi}{4}, \frac{dy}{dx} = -\tan\left(\frac{3\pi}{4}\right) = 1$

148. **(a)** Let $y = \sin x, z = \log x$

Then $\frac{dy}{dz} = \frac{\left(\frac{dy}{dx}\right)}{\left(\frac{dz}{dz}\right)} = \frac{\cos x}{\left(\frac{1}{x}\right)} = x\cos x$

149. **(d)** $-1 \leq \sin x \leq 1$

$\Rightarrow 1 \geq -\sin x \geq -1$

$\Rightarrow 1 + 1 \geq 1 - \sin x \geq 1 - 1$

$\Rightarrow 0 \leq 1 - \sin x \leq 2$

Then min value $= 0$

150. **(d)** $f(x) = \tan x - x$

$f^1(x) = \sec^2 x - 1 = \tan^2 x \geq 0, \forall x$

Then f always increases

151. **(c)** $\frac{1}{(1+x)(x+2)} = \frac{1}{x+1} - \frac{1}{x+2}$

$\int \frac{1}{(x+1)(x+2)}dx = \int \frac{1}{x+1}dx - \int \frac{1}{(x+2)}dx =$

$\log|x+1| - \log|x+2| + c$

$= \log\left|\frac{x+1}{x+2}\right| + c$

152. **(c)** $f(x) = \sin^5 x\cos^4 x$

$f(-x) = -\sin^5 x\cos^4 x = -f(x)$

$\int_{-1}^{1} \sin^5 x\cos^4 x dx = 0$

$\int_{-a}^{a} f(x)dx = 0$ when $f(-x) = -f(x)\Big)$

153. **(d)** $\int_0^{2\pi} \sqrt{1 + \sin\left(\frac{x}{2}\right)}dx$

$= \int_0^{2\pi} \sqrt{\left(\cos\left(\frac{x}{4}\right) + \sin\left(\frac{x}{4}\right)\right)^2}dx$

$= \int_0^{2\pi} \left(\cos\left(\frac{x}{4}\right) + \sin\left(\frac{x}{4}\right)\right)dx$

$= 4\,{}_0^{2\pi}\left[\sin\left(\frac{x}{4}\right) - \cos\left(\frac{x}{4}\right)\right]_0^{2\pi}$

$= 4\left[\sin\left(\frac{\pi}{2}\right) - \cos\left(\frac{\pi}{2}\right) - \left(\sin 0 - \cos\frac{\pi}{2}\right)\right]$

$= 4[(1-0) - (0-1)] = 4 \times 2 = 8$

154. **(c)** $\int \frac{1}{x^2(x^4)^{3/4}\left(1+\frac{1}{x^4}\right)^{3/4}}dx$

Put $1 + \frac{1}{x^4} = t$

$-4x^{-5}dx = dt$

$x^{-5}dx = \frac{dt}{-4}$

$= \int \frac{-dt}{4t^{3/4}} = \frac{-1}{4}\frac{t^{-3/4+1}}{\frac{-3}{4}+4} + c$

$= -\left(1 + \frac{1}{x^4}\right)^{\frac{1}{4}} + c = -\left(\frac{x^4+1}{x^4}\right)^{\frac{1}{4}} + c$

155. **(a)** Let $I = \int_0^1 \log\left(\frac{1-x}{x}\right)dx$

$= \int_0^1 (\log(1-x) - \log(x))dx$

$\because \int_0^a f(x)dx = \int_0^a f(a-x)dx$

$= \int_0^1 (\log x - \log(1-x))dx$

$I = -I \Rightarrow I = 0$

156. **(b)** $\int_0^{3\pi} \sin\left(\frac{x}{3}\right) dx$

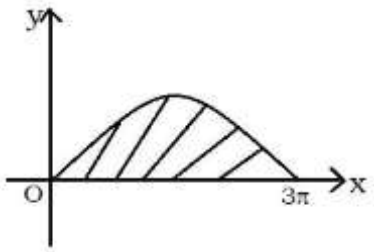
For

$= \left[\frac{-\cos(x/3)}{1/3}\right]_0^{3\pi}$

$= -3\left(\cos\left(\frac{3\pi}{3}\right) - \cos 0\right)$

$= -3(-1-1) = 6$ sq units

$x \in (0,3\pi), \sin\left(\frac{x}{3}\right) > 0$



157. **(a)** $A = 2\int_0^{16} x dy = 2\int_0^{16} \sqrt{y} dy$

$= 2 \times \frac{2}{3}\left[y^{3/2}\right]_0^{16} = \frac{4}{3}(16)^{3/2}$

$= \frac{4}{3} \times 64 = \frac{256}{3}$

158. **(d)** $P = \tan x, Q = \sec x$

$I.F = \sec x$

$y\sec x = \int \sec x \cdot \sec x dx + c = \tan x + c$

159. **(c)** Order $= 2$, degree $= 2$

$a = 2, b = 2$

$a - b = 0$

160. **(c)** The distance of $P(-3,4,5)$ from yz -plane is $|x| = |-3| = 3$

161. **(d)** $A = \{-3,3\}, B = \{2,3,4\}, C = \{2,3\}$

$B - C = \{4\}, (B - C) \cup A = \{-3,3,4\}$

162. **(a)** $n(A) = 3, n(B) = 6$

Minimum elements of $A \cup B$ is 6

Maximum no.of elements of $A \cap B$ is 3

163. **(a)** $(x-2)(x-5) > 0$

$(-\infty, 2) \cup (5, \infty)$

164. **(c)** $f(x) = \sin 9x + \sin 10x$

$f\left(\frac{\pi}{2}\right) = 1 + 0 = 1$

$f\left(\frac{\pi}{4}\right) = \frac{1}{\sqrt{2}} + 1$

$f(\pi) = 0$

$f(0) = 0$

165. **(d)** $\cos 5\pi = -1$

$\cos 4\pi = 1$

$\cos 5\pi \neq \cos 4\pi$

166. **(a)** $\cos x = \cos^2 x - 1 = \sin^2 x$

$\sin^2 x + \sin^4 x = \cos x + \cos^2 x = 1$

167. **(a)** $\bar{x} = \frac{4+7+8+9+10+12+13+17}{8} = 10$

$\Sigma\frac{|\bar{x}-x_i|}{n}=\frac{6+3+2+1+0+2+3+7}{8}=\frac{24}{8}=3$

168. **(d)** $12a+12b=1$

$a+b=1/12$

$w_1+w_2+w_3+w_4+w_5=1$

$\frac{1}{6}+a+w_3+b+\frac{1}{12}=1$

$w_3+\frac{1}{6}+\frac{1}{12}+a\times b=1$

$w_3+\frac{1}{16}+\frac{1}{12}+\frac{1}{12}=1$

$w_3=1-\frac{1}{3}\Rightarrow w_3=\frac{2}{3}$

169. **(a)** $P(1)=\frac{2}{6},P(3)=\frac{1}{6}$

$P(1 \text{ ro } 3)=P(1)+P(3)=3/6=\frac{1}{2}$

170. **(b)** $R_1=\{(a,a),(3,b),(c,c),(b,c),(c,b)\}$

$R_2=$ universal relation

No. of equivalence relations $=2$

171. **(d)** St II is false, $f+g=\sin x+\cos x\ (f+g)(0)=(f+g)(\pi/2)=1$

172. **(b)** $\tan A=2,\cot B=3$

$\sec^2 A+\text{cosec}^2 B=(\sqrt{5})^2+(\sqrt{10})^2=15$

173. **(c)** $-\frac{\pi}{2}\le 2\cos^{-1}x\le\frac{\pi}{2}$

$-\frac{\pi}{4}\le\cos^{-1}x\le\frac{\pi}{4}$

$0\le\cos^{-1}x\le\frac{\pi}{4}\Rightarrow 1\ge x\ge\frac{1}{\sqrt{2}}$

174. **(d)** Both are true

175. **(b)** Corner points $z=3x+4y$

$x=(0,0)$	0
$B=(40,0)$	120
$C=(20,20)$	140(Maximum)
$D=(0,30)$	120

176. **(b)** E & F are independent E'&F' also independent

177. **(c)** $\frac{P(A\cap B)}{P(B)}=\frac{P(B\cap A)}{P(A)}\ P(A)=P(B)$

178. **(b)** $A\subseteq B\Rightarrow A\cap B=A$

$\Rightarrow P(A\cap B)=P(A)$

$P\left(\frac{A}{B}\right)=\frac{P(A\cap B)}{P(B)}=\frac{P(A)}{P(B)}\ge P(A)$

179. **(c)** $P(E_1)=\frac{2}{5},P(E_2)=\frac{3}{5}$

$P(A/E_1)=\frac{1}{3},P(A/E_2)=\frac{2}{7}$

$P(E_2/A)=\frac{\frac{3}{5}\times\frac{2}{7}}{\left(\frac{3}{5}\times\frac{2}{7}\right)+\left(\frac{2}{5}\times\frac{1}{3}\right)}=\frac{9}{16}$

180. **(c)** $\overline{z_1+z_2}\ne\overline{z_1}+\overline{z_2}$

Biology

181. **(c)**

182. **(a)**

183. **(a)**

184. **(b)**

185. (c)
186. (c)
187. (a)
188. (a)
189. (a)
190. (d)
191. (b)
192. (c)
193. (a)
194. (b)
195. (b)
196. (d)
197. (d)
198. (d)
199. (d)
200. (d)
201. (b)
202. (d)
203. (a)
204. (c)
205. (a)
206. (a)
207. (a)
208. (d)
209. (b)
210. (c)
211. (b)
212. (a,b)
213. (c)
214. (a)
215. (a)
216. (c)
217. (c)
218. (d)
219. (c)
220. (a)
221. (c)
222. (d)
223. (b)
224. (c)
225. (c)
226. (d)
227. (d)
228. (a)
229. (b)
230. (a)
231. (a)
232. (d)
233. (a)

234. (a)
235. (d)
236. (d)
237. (b)
238. (d)
239. (a)
240. (c)