tive organisms retain the initial violet stain, while gram-negative organisms are decolorized by the organic solvent and hence show the pink counterstain. The difference between gram-positive and gram-negative bacteria lies in the ability of the cell wall of the organism to retain the crystal violet.

18. (3) PLANTS absorb light for photosynthesis but as light can itself be dangerous to plants, they need to protect themselves against its damaging effects. Photorespiration is a light induced oxidation of photosynthetic intermediate with the help of oxygen. Photorespiration is stimulated by (i) low CO_2 concentration (ii) high light intensity (iii) high O_2 concentration (iv) high temperature (v) aging of leaf

(Source Internet) Photorespiration results from the oxygenase reaction catalysed by ribulose-1,5-bisphosphate carboxylase/oxygenase. In this reaction glycollate-2-phosphate is produced and subsequently metabolized in the photorespiratory pathway to form the Calvin cycle intermediate glycerate-3-phosphate. During this metabolic process, CO_2 and NH_3 are produced and ATP and reducing equivalents are consumed, thus making photorespiration a wasteful process. However, precisely because of this inefficiency, photorespiration could serve as an energy sink preventing the over-reduction of the photosynthetic electron transport chain and photoinhibition, especially under stress conditions that lead to reduced rates of photosynthetic CO_2 assimilation. Furthermore, photorespiration provides metabolites for other metabolic processes, e.g. glycine for the synthesis of glutathione, which is also involved in stress protection. In this review, we describe the use of photorespiratory mutants to study the control and regulation of photorespiratory pathways. In addition, we discuss the possible role of photorespiration under stress conditions, such as drought, high salt concentrations and high light intensities encountered by alpine plants.

19. (4) Photosynthetically C_4 plants are more efficient than C_3 plants because these have Kranz anatomy (connetive undifferentiated mesophyll around vascular bundles with chloroplast containing bundle sheaths). Bundle sheeth chloroplasts are larger agranal and without PS-II activity and perform CC_3 cycle. (Kalvin cycle)

20. (1) Eukaryotic ells have the ability to adopt a variety of shapes and carry out directed movements because they have a network of protein fibres that support the shape of the cell and keep intact the organelles of the cell. This cytoskeleton (network of protein fibres) are made up of actin filaments (microtubulents-stress fibres), microtubules and intermediate filaments.

21. (2) Both the assertion and reason are independently true but the reason does not satisfies the assertion. Starch is used in iodometric titration as an indicator because starch gives blue colour with free iodine. This blue colour disappears when free iodine is completely changed to iodide ion.

22. (1) As the bond order (B.O) increases bond length decreases and *vice versa*.

$$\text{B. O of } N_2 = \frac{1}{2}$$

(No. of bonding electron – No. of antibonding electron)

$$= \frac{1}{2}(6-0) = 3$$

$$\text{B. O of } O_2 = \frac{1}{2}$$

(No. of bonding – No. of antibonding electron)

$$= \frac{1}{2}(6-2) = 2$$

B. O of N_2 is 3 and B.O of O_2 is 2, therefore, bond length of N_2 is less than O_2

23. (1) Optical isomerism only can be shown by the compound which are dis-symmetrical or assymmetrical. The compound $[CO(NO_2)_3(NH_3)_3]$ is symmetrical because it has plane of symmetry therefore, it will not show optical isomerism.

24. (2) Down the series E° value becomes more negative. In the electrochemical series chromium present below Mn, that is why Mn has more positive E° value than chromium.

Third ionisation potential of Mn is larger tan third 1P of Cr because the electronic configuration of Mn^{2+} is $3d^5\ 4s^\circ$ and Cr^{2+} is $3d^4\ 4s^\circ$. Mn^{2+} has half filled $3d^5$ configuration which is more stable than $3d^4$ (less than half filled) configuration of Cr^{2+} therefore, it is difficult to remove the next electron (3^{rd} electron) from Mn^{2+} ($3d^5$ configuration) as compare to $3d^4$ of Cr^{2+} hence, third IP of Mn is more than third IP of Cr.

25. (3) It is true that $K_2Cr_2O_7$ (potassium dichromate) is used as a primary standard in volumetric analysis because it is not hydroscopic in nature and therefore, it does not gain weight by absorbing moisture which leads to purity in state and hence can be measured accurately. But $K_2Cr_2O_7$ is less soluble in water.

26. (3) Silicons are polymeric organosilicon derivatives containing Si – O – Si links. Silicons are inert and strongly water repellent. The tendency for such inertness towards acid, bases, alkalis and water repellent is due to the presence of larger (bulky) organic groups which surrounds the silicone chain.

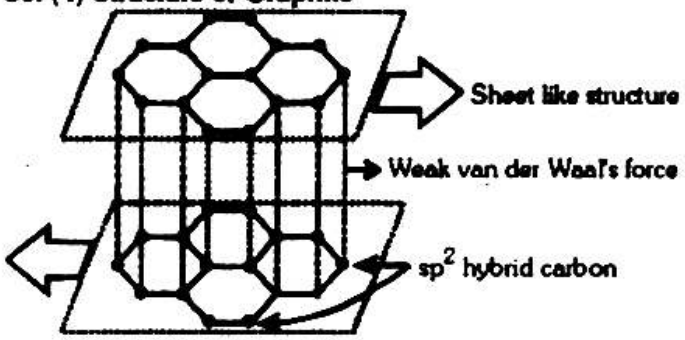
27. (1) According to transition state theory, for the formation of an activated complex one of the vibrational degrees of freedom is converted in to a transitional degree of freedom. It is because the energy of activated complex is higher than the energy of reactant molecules

28. (1) At room temperature, fusion of ice is a spontaneous process, because the process again proceeds in that direction where randomness increases. Liquid state (water) is more random (i. e., larger entropy) than solid state (ice). Hence, the melting of ice into water is spontaneous process

29. (4) The assertion is wrong because Sb_2S_3 is soluble in yellow ammonium sulphide.

$$Sb_2S_3 + 3(NH_4)_2S \longrightarrow 2(NH_4)_3SbS_3$$

30. (4) Structure of Graphite



(Graphite)

The above figure shown sheet like hexagonal structure of graphite in which each carbon atom is sp^2 hybridized. For tetragonal system $a = b \neq c$, $\alpha = \beta = \gamma = 90°$. But for a hexagonal system $a = b \neq c$, $\alpha = \beta = 90°$, $\gamma = 120°$.

31. (2) Both the statements are true independently but reason does not satisfies the assertion. The opposite potential if larger than cell potential than the direction of flow of current will be reversed and it will reverse the cell reaction also, it means where oxidation was vice versa. Now zinc ion are converted to zinc (s) (reduction) at one electrode and Cu is converted in to Cu^{2+} ion (oxidation).

$$Zn^{2+}(aq) + Cu(s) \longrightarrow Cu^{2+}(aq) + Zn(s)$$

32. (3) It is true that Fe^{3+} ion can be used for coagulation of As_2S_3 sols. It is due to the fact that when different or oppositely charged sols are mixed together in nearly equal proportions both the sols may be precipitated totally or partly. When As_2S_3 (negatively charged) is added to $Fe(OH)_3$ (positively charged) sols, both the sols get precipitated simultaneously if such addition of sols are volumetrically equal or nearly equal.

33. (3) Due to osmosis pure water will enter into the blood cells, which led to increase in internal pressure therefore cell swells. If we see the concentration of salt in the blood cell, it will decrease after osmosis.

34. (3) Ethyl alcohol is volatile and comes out with the Breath of drunker. When these small vapour of ethyl alcohol is treated with or get contact with acidic $K_2Cr_2O_7$ solution, the colour of the solution changes from orange to green.

The reaction involved in above alcohol drunk test is

$$\underset{\text{(Ethyl alcohol)}}{CH_3CH_2-OH} \xrightarrow[[O]]{K_2Cr_2O_7/H_2SO_4} \underset{\text{(ORANGE COLOUR)}}{} \underset{\text{(Aldehyde)}}{CH_3CHO}$$

$$\xrightarrow[[O]]{K_2Cr_2O_7/H_2SO_4} \underset{\text{(ORANGE COLOUR)}}{} \underset{\text{(Acetic acid)}}{CH_3COOH}$$

Here $K_2Cr_2O_7$ acts as oxidising agent in the presence of H_2SO_4. $K_2Cr_2O_7$ oxidises CH_3CH_2OH and itself get reduced. The reduced part becomes $Cr_2(SO_4)_3$, chromic sulphate which is green in colour.

$$\underset{\text{(Orange)}}{K_2Cr_2O_7} + 4H_2SO_4 \longrightarrow K_2SO_4 + \underset{\text{(green)}}{Cr_2(SO_4)_3} + 4H_2O + 3[O]$$

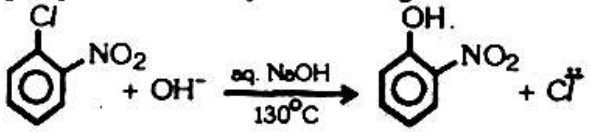
35. (3) It is true that anilinium chloride is more acidic than ammonium chloride. But anilinium ion is less resonance stablised than aniline, because anilinium ion does not contain lone pair of electrons, therefore resonance is not possible.

Stronger acid has weaker conjugate base and vice versa. on the basis if above fact, anilinium ion is stronger acid because aniline is weaker conjugate base.

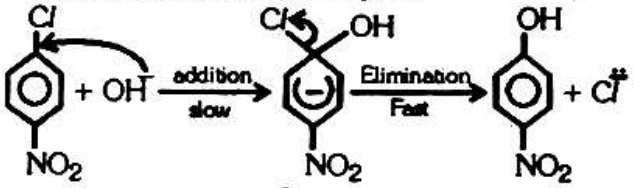
$$\underset{\substack{\text{Anilinium ion}\\\text{(Stronger Acid)}}}{C_6H_5\overset{+}{N}H_3} \longrightarrow \underset{\substack{\text{Aniline}\\\text{(Weaker conjugate base)}}}{C_6H_5NH_2} + H^+$$

36. (3) Diastereomers – Stereoisomers which are not mirror images of each other are called diastereomers. These compounds have different physical property.

37. (1) Both the statement is correct and reason explains the assertion. The nucleophilic substitution can occur when strong electron-withdrawing groups are *ortho* or *para* to halogen atom.

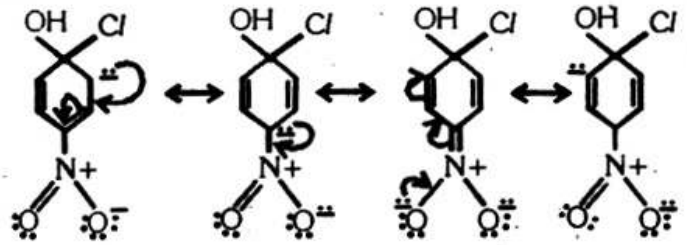


The mechanism that operates in these reactions is an *addition - elimination* mechanism involving the formation of a carbanion with delocalised electrons called a *Meisenheimer complex*.



Carbanion
(Meisenheimer Complex)

Carbanion is stabilized by electron - withdrawing groups ($-NO_2$) in the positions *ortho* and *para* to the halogen atom



Especially stable
(-ve charges are both an oxygen atom)

38. (4) 1, 3-Butadiene is not a monomer of natural rubber but it is isoprene i. e., 2-methyl-1, 5-butadiene. It is a general rule that unsaturated monomer when polymerises it gives poly addition product. Such addition in the case of natural rubber is through cationic addition polymerization. The reaction involved in cationic addition is

$$n\ CH_2 = \underset{\displaystyle CH_3}{\overset{|}{C}} - CH = CH_2 \xrightarrow{\text{Polymerisation}} \left(CH_2 - \underset{\displaystyle CH_3}{\overset{|}{C}} = CH - CH_2 \right)_n$$

39. (4)

$$\underset{\text{2-Butene}}{CH_3 - CH = CH - CH_3} \xrightarrow{HBr} \underset{\displaystyle Br}{\overset{|}{CH_3 - CH} - CH_2 - CH_3}$$

2- Bromobutane

Above reaction gives only one product i. e., 2-bromobutene

40. (1) Addition of non-volatile solute in to any volatile solvent reduces the vapour pressure. Such reduce in vapour pressure will be in equilibrium with solid phase at lower pressure and hence at a lower temperature. Such addition of non-volatile solute in to solvent results in to depression of freezing point of the solvent.

41. (3) For a wave to propagate in sky, it has to satisfy the principle of sky wave propagation. According to the principle, if the frequencies of the waves are less than the critical frequency then the waves would be reflected back since the ionosphere has refractive index less than free space. Thus the assertion is wrong. The statement given in reason is correct but it is not true for the assertion

42. (2) For heavy nuclei (A>100), the binding energy per nuclear decreases due to coulomb repulsion between the protons inside the nucleus

43. (3) The assertion is true because the common base configuration of npn transistor is used for voltage amplification with the current amplification being very small.

The reason is incomplete and is thus wrong because the collector is reverse biased for voltage amplification which has not been mentioned.

44. (2) The entropy of an isolated system increases in accordance with the second law of thermodynamics.

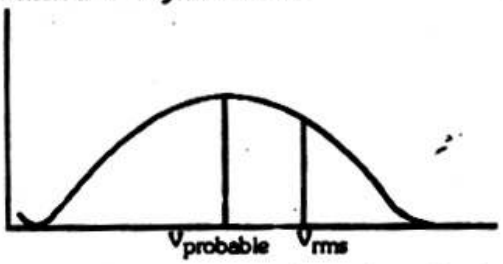
45. (1) The phenomenon of nuclear magnetic resonance is used in Magnetic Resonance Imaging, thus both assertion and reason are correct.

46. (1) The judo fighter initially has to try to bend his opponent and then rotate him around his hip because, then the opponents moment of inertia would be reduced and due to the any torque given by a force would be resisted but not the torque by rotation.

47. (4) The root mean square and the most probable speeds are given by $v_{rms} = \sqrt{\frac{3RT}{M}}$

and $v_{probable} = \sqrt{\frac{2RT}{M}}$

and the maxwellian distribution of velocity is given by which is not symmetrical.



48. (3) The ball bearing is used to reduce the friction

49. (1) Gratings produced diffraction patterns and they cannot distinguish different wavelengths as their spacing is not of the same order.

50. (4)

51. (2) A man inside a freely falling lift falls with zero relative acceleration

The reason is correct but is not a correct explanation

52. (3) The reason is wrong as the work function is dependent only on the photoelectric metal.

53. (1) **54.** (1)

55. (3) As the skin loses water due to perspiration, it enhances its emissivity.

56. (2) The reason is not the correct explanations

57. (1) **58.** (2) **59.** (1) **60.** (1)

61. (2) $\mu s = \sqrt{n(n+2)}$

where μs = spin only magnetic moment

n = number of unpaired electrons

If number of unpaired electrons are same μs will be same. In Cr^{2+} and Fe^{2+} the number of unpaired electron is 4 therefore μs is same. Co^{2+} has 3 unpaired electrons and Mn^{2+} has 5 unpaired electrons.

62. (4) Haemoglobin (Haem - ion; globin - globular protein) contain iron as central atom in prohpyrin ring. Cytochromes are widely distributed respiratory catalyst concentrated in electron transport chain of living cells. Cytochromes are haemoproteins differing in prophyrin groups. It also contains iron in its prophyrin ring.

63. (1) $Na_2B_4O_7$ (Borax) when dissolves in water and gives its alkaline solution. Because of this reason borax is used as water softening and cleansing agent

$$Na_2B_4O_7 + 2H_2O \longrightarrow \underset{\text{Strong base}}{2NaOH} + \underset{\text{Weak acid}}{H_3BO_3}$$

Sodium hydroxide cleans and softens the water.

64. (3) Sulfur (Sulphur) exist in several allotropic forms i. e., α, β and γ sulphur. All the three forms contains Puckered S_8 ring with crown conformations. But Engel's sulphur (ε– sulphur) contains S_6 rings. Some other form of sulphur (allotropes) have been synthesized are

S_7, S_9, S_{10}, S_{11}, S_{12}, S_{18} and S_{20}

65. (1) Sodium bicarbonate and magnesium hydroxide are used to prepare *antacid* or anti acid medical preparations.

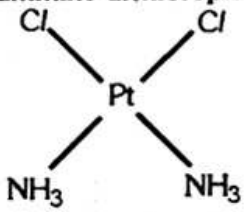
$$NaHCO_3 + HCl \longrightarrow NaCl + H_2O + CO_2$$

$$Mg(OH)_2 + 2HCl \longrightarrow MgCl_2 + 2H_2O$$

Both the compounds reacts with HCl and neutralizes the acids and increase the pH of stomach.

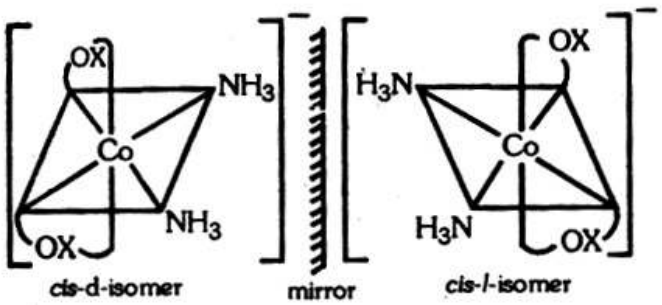
66. (2) The glass is an amorphous substance which is clear (watery) solid. It can some time be coloured after mixing transition element (especially its ions). On mixing Co^{2+} ion in the glass gives deep blue colour.

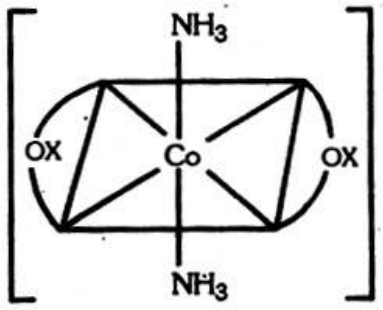
67. (1) The central atom in cisplatin is Pt and the ligands are Cl and NH_3. The IUPAC name of cisplatin is cis-diammine dichloroplatinum (II).



It is used as anticancer drug. The structure of cisplatin is

68. (3) $[Co(C_2O_4)_2(NH_3)_2]^-$

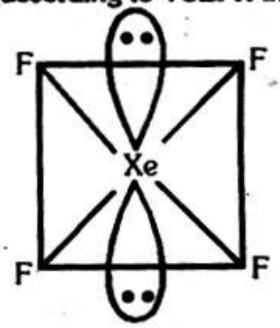




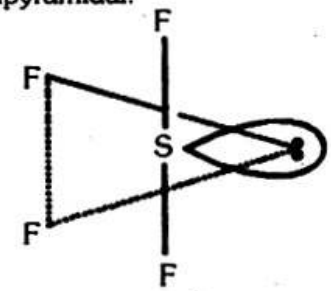
trans-isomer

69. (3) In Haber - Bosch process ammonia gas is prepared by reacting H_2 and N_2 in the presence of finely divided iron (catalyst) and molybdenum (promoter).

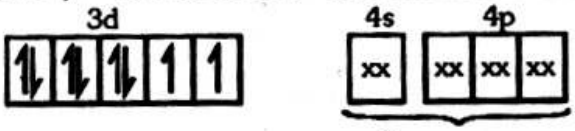
70. (1) XeF_4 involves sp^3d^2 hybridisation and its shape square planar instead of octahedral due to presence of two lone pair of electron of Xe atom. Here two lone pair of electron will occupies the polar position (according to VSEPR theory)



SF_4 molecule involved sp^3d hybridisation and due to presence of one lone pair of electron the distorted geometry of see-saw like structure instead of trigonal bipyramidal.



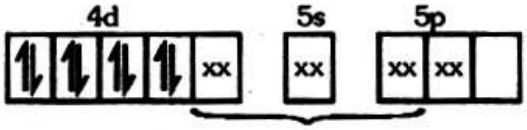
$[NiCl_4]^{2-}$ ion involved sp^3 hybridisation as follows



sp^3 hybridisation

Due to sp^3 hybridisation its shape is tetrahedral.

$[pd\ Cl_4]^{2-}$ ion involved $d\,sp^2$ hybridisation as follows



dsp^2 hybridisation

Due to the $d sp^2$ hybridization $[pd Cl_4]^{2-}$ ion shows square planar geometry.

71. (2) Tincture iodine is a solution of I_2 in aqueous KI.

72. (3) $[Ag (C \overset{\sigma}{\equiv} N)_2]^-$ has 4π bond which is clear from the diagram.

$$[N \overset{\pi}{\underset{\pi}{\equiv}} C - Ag - C \overset{\pi}{\underset{\pi}{\equiv}} N]^- \text{ ion.}$$

73. (1) The compound phosphorus pentachloride (PCl_5) behaves as molecule in gaseous phase. In solid state it acts as ionic solid as

$[PCl_4]^+$ $[PCl_6]^-$
Cationic Anionic

74. (1) Potassium iodate and potassium iodide salts are used to prepare iodide salt when its traces are mixed with large amount of NaCl

75. (1) U_3O_8 is the compound used in enrichment of Uranium for power plant. These U_3O_8 contains Uranium - 235

76. (1) $K.E = \frac{1}{2} m V^2$

(where m = mass, V = velocity)

$\Rightarrow \quad 0.5 = \frac{1}{2} \times 1 \times V^2$

$\Rightarrow \quad V = 1 \text{ m/s}$

de Broglie wavelength,

$$\lambda = \frac{h}{mV} = \frac{6.626 \times 10^{-34} \text{ Js}}{1 \text{ Kg} \times 1 \text{ ms}^{-1}}$$

$$\lambda = 6.626 \times 10^{-34} \text{ m}$$

77. (2) If the compressibility factor is Z then dominance of strong repulsive force depends on $Z > 1$.
If $Z < 1$ it is due to attractive force.

78. (3) 40 ml of 0.1 M NH_3 solution = 40×0.1

$\Rightarrow$ 4 milli equivalent ammonia solution

20 ml of 0.1 M HCl = 20×0.1

$\Rightarrow$ 2 milli equivalent of HCl

For the reaction

$$NH_4OH + HCl \longrightarrow NH_4Cl + H_2O$$

Initially	4	2		0
After reaction	4 – 2	0		2
	= 2			

$$\therefore \quad pOH = pKb + \log \frac{[NH_4Cl]}{[NH_4OH]} = 4.74 + \log \frac{2}{2}$$

$\Rightarrow \quad pOH = 4.74 + \log 1 = 4.74$

$\therefore \quad pH = 14 - 4.74 = 9.26$

79. (4) Total change in entropy,

$$\Delta S_{total} = \Delta S_{system} + \Delta S_{surroundings}$$

For spontaneous process ΔS_{total} must be positive.

$\Rightarrow \quad \Delta S_{total} > 0$

$\Rightarrow$ Total entropy change is always positive if process is spontaneous.

80. (1) The Ca^{2+} ions are arranged in ccp arrangement. In this arrangement Ca^{2+} ions are present at all corners and at the centres of each face of the cube. The fluoride ion (F^-) occupy all the tetrahedral site. There are two tetrahedral sites per atom in a closed packed lattice. This means that there are two tetrahedral sites every Ca^{2+} ion. Since F^- ions occupy all the tetrahedral sites, there will be two F^- ions. Thus the formula of the compound is CaF_2.

81. (2) $MnO_4^- + 2 H_2O + 3 e^- \longrightarrow MnO_2 + 4 OH^-$

It is clear from the above equation that for the reduction of one mole of MnO_4^- ion to MnO_2 3 electron is required . It is because the oxidation state of Mn in MnO_4^- ion is + 7 and the oxidation state of Mn in MnO_2 is + 4.

82. (3) For the reaction

$x_1 A + x_2 B \longrightarrow y_1 C + y_2 D$

Rate expression for the above reaction is

$$-\frac{1}{x_1}\frac{d[A]}{dt} = -\frac{1}{x_2}\frac{d[B]}{dt} = \frac{1}{y_1}\frac{d[C]}{dt} = \frac{1}{y_2}\frac{d[D]}{dt}$$

Now, for the reaction

$$2 N_2O_5 \longrightarrow 4 NO_2 + O_2$$

Rate expression is

$$-\frac{1}{2}\frac{d[N_2O_5]}{dt} = \frac{1}{4}\frac{d[NO_2]}{dt} = \frac{d[O_2]}{dt}$$

83. (1) For the reaction

$$H_2O (l) \rightleftharpoons H_2O (s)$$

For a phase change $\Delta G = 0$

Because $\Delta G^\circ = RT \ln K$

[ΔG° = standard free energy change, K=equilibrium constant]

If a substance is in equilibrium between two phases at constant temperature and pressure the free energy change is zero.

84. (3) For water $K_f = \frac{\Delta T_f \times W \times m}{1000 \times \omega}$

(Where W=weight of water, ω=wt. of cane sugar, m=molecular wt. of cane sugar)

$$K_f = \frac{2.15 \times 100 \times 342}{1000 \times 5} = 14.7$$

For 5% $C_6H_{12}O_6$

$$\Delta T_f = \frac{K_f \times 1000 \times \omega'}{W \times m'}$$

(where ω' = wt. of $C_6H_{12}O_6$, m' = molecular wt. of $C_6H_{12}O_6$)

$$\Delta T_f = \frac{14.7 \times 1000 \times 5}{100 \times 180} = 4.08$$

Now, freezing point of $C_6H_{12}O_6$ solution

$= 273 - 4.08 = 269.07$ K

85. (1) The order of energy gap is

$Eg_{(diamond)} > Eg_{(silicon)} > Eg_{(germanium)}$

As the energy gap (Eg) increases conductivity decreases.

86. (2) The change in enthalpy

$$\Delta H = \Delta U + \Delta n\, R\, T$$

(where Δn = no. of gaseous product – no. of gaseous molecule)

$-92.38 \times 1000 = \Delta U - 2 \times 8.314 \times 298$

(Reactant is more in number than product so negative sign is there)

$\Delta U = -87424$ J $= -87.424$ k J

87. (3) For the electrolysis of the salt

$NaBr \rightleftharpoons Na^+ + Br^-$

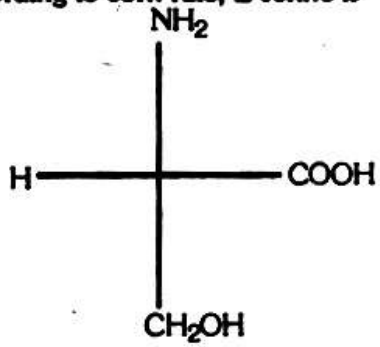
$H_2O \rightleftharpoons H^+ + OH^-$

At cathode, $2H^+ + 2e^- \rightarrow H_2\uparrow$

At anode, $2Br^- - 2e^- \rightarrow Br_2\uparrow$

In solution, $Na^+ + OH^- \rightarrow NaOH$

88. (3) According to corn rule, L-serine is

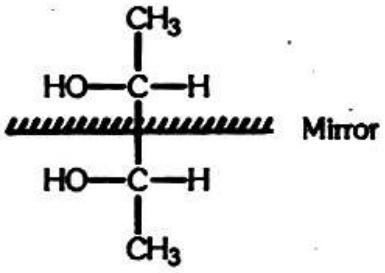


L - Serine

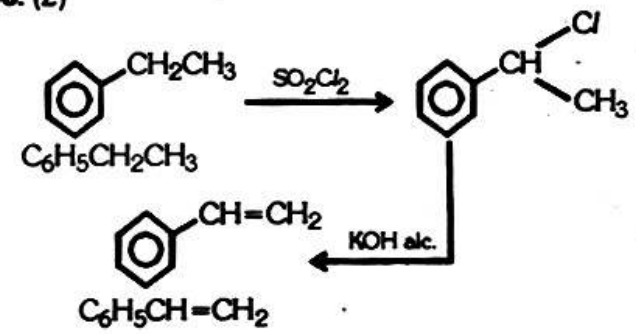
2-amino-3-hydroxypropanoic acid.

It the priority groups i.e., $-NH_2$, $-COOH$, $-CH_2OH$, $-H$ are arranged clockwise it is said to be a L - form.

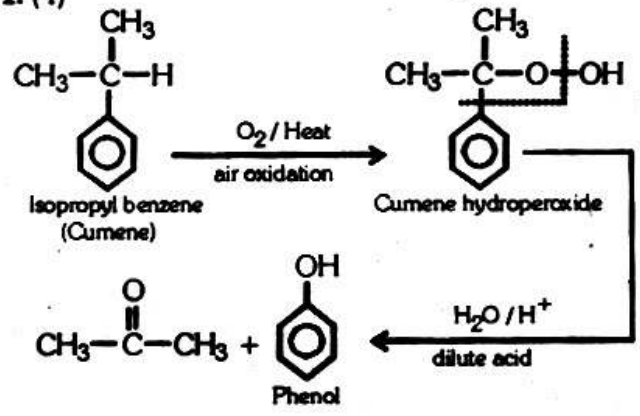
89. (2)



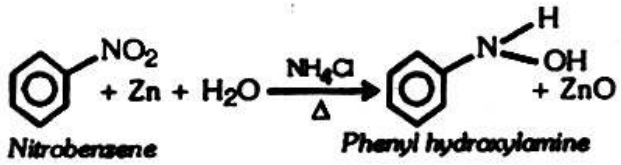
90. (2)



91. (4)

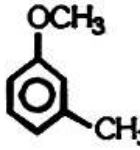


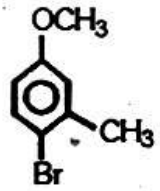
92. (4)



93. (2) It two *o* and *p* - directing group is attached to an aromatic ring the directing power of attached group is in the order of

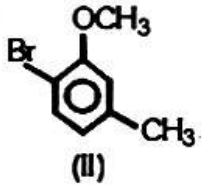
$O^- > -NH_2 > -NR_2 > -OH > -O-CH_3 > -NHAc > -CH_3 > X$

So, monobromination of  will be



(I)

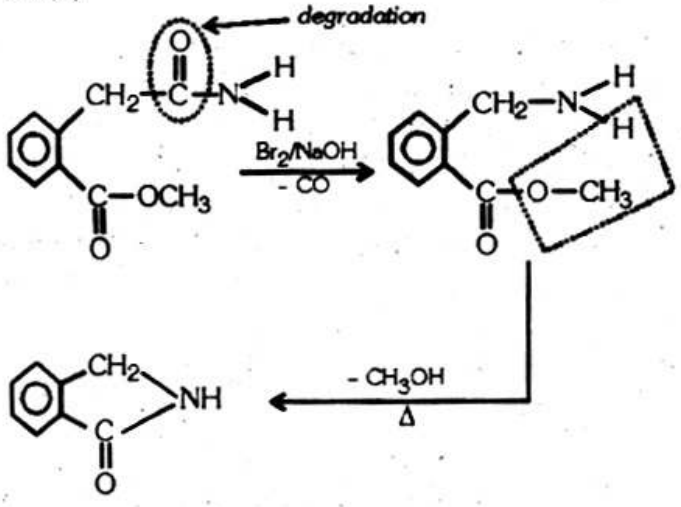
and



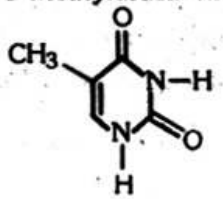
(II)

Compound (I) will be preferred of less steric effect.

94. (3)



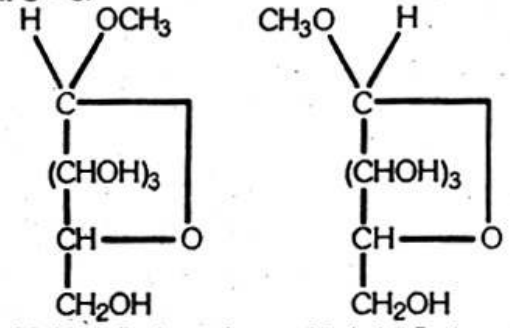
95. (1) Thymine is 5-methyluracil. Its structure is



Thymine. (A nitrogenous base in nucleic acid.

96. (4) Lysin is an aminoacid, it is soluble in law pH or in acidic medium but it is less soluble in isoelectric pH i. e., basic pH or high pH.

97. (2) Methyl – α – D – glucoside and methyl – β – D-glucoside are anomers because they differs only at C – 1.



98. (2) Boiling point increases if size of alkyl group increase and boiling point decreases if branching increases.

So the order of boiling point.

$$CH_3-CH_2-CH_2-CH_2-Cl > CH_3-CH_2-CH_2-Cl > CH_3CH(CH_3)CH_2Cl > (CH_3)_3C\,Cl$$

99. (1) The increasing order of reactivity of halides for S_N1 reaction is

$$CH_3-CH_2-x < (CH_3)_2CH-X < CH_2=CH-CH_2-X < PhCH_2-X.$$

100. (4)

$$CH_3\underset{\displaystyle Cl}{\underset{|}{C}}H-CH_2-CH_2-OH \xrightarrow{\text{aq. KOH}} CH_3-\underset{\displaystyle OH}{\underset{|}{C}}H-CH_2-CH_2-OH$$

(Major product)

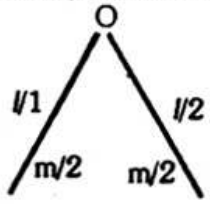
In this reaction halogen atom is replaced by – OH group (nucleophile).

101. (3) Light bends since the speed of light is different in different media.

102. (4) The acceleration due to gravity is independent of the mass

103. (2) The moment of inertia of the rod about its centre and perpendicular to its axis is $\frac{1}{12}ML^2$ and the moment of inertia about one end $= \frac{ML^2}{3}$,

so the moment of inertia about 0 is



$$= \frac{M}{2}\frac{(l/2)^2}{3} + \frac{M}{2}\frac{(l/2)^2}{3} = \frac{ML^2}{12}$$

104. (3) Given $\lambda = 100$ m, $v = 25$ m/sec

then the frequency $= \frac{25\text{ m/sec}}{100\text{ m}} = \frac{1}{4}\text{ sec}^{-1}$

So the time of bounce = 4 sec

105. (3) The atm a spheric pressure = 760 mm of Hg

The pressure in the lungs = 750 mm of Hg

so the difference in pressure = 10 mm

= 1 cm of Hg

and the density = 13.6 g/cm^3

so we have $1 \times 13.6 \times g = l \times 1 \times g$

so $l = 13.6$ cm

Thus water can be drawn from a depth of 13.6 cm.

106. (3) The surface charge densities on the sheets are given by $\sigma = 26.4 \times 10^{-12}$ c/m^2 so the electric field between the sheets is

$$E = \frac{\sigma}{\epsilon_o} = \frac{26.4 \times 10^{-12}}{8.85 \times 10^{-12}} \approx 3\text{ N/C}$$

107. (2) The dimension of magnetic moment is [L^2 A]

108. (1) Given $u = -8$ cm, $f = 10$ cm

so using $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

we get $\frac{1}{v} = \frac{1}{u} + \frac{1}{f}$

$$= \frac{-1}{8} + \frac{1}{10} = \frac{-10+8}{80} = \frac{-2}{80}$$

so $v = -40$ cm

hence the magnification produced by the lens is

$$m = \frac{v}{u} = \frac{-40}{-8} = 5$$

109. (2) Given $\lambda_{min} = 10^{11}$ m.

So $$V_{max} = \frac{hC}{e\lambda_{min}} = \frac{1.242 \times 10^{-6}}{10^{-11}}$$

so $V_{max} = 124.2$ kV

Which is the accelerating voltage.

110. (2) The electrons are ejected if the incident light has certain minimum frequency

111. (2) Given $a_{\mu g} = 1.5$

then the focal length of lens by 'f'

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

$$\frac{1}{f} = 0.5\left(\frac{1}{R_1} - \frac{1}{R_2}\right) \quad \text{- - - (i)}$$

when the lens is immersed in a liquid of refraction index 1.25, then

$$\frac{1}{f'} = 0.25\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

so $f' = 2.5\,f$

112. (1) The voltage on the clouds = 4×10^6 volts

Time of strike = 100 m sec

Charge delivered = 4 coulomb

So the power lightening = $\frac{\text{Work done}}{\text{Time}}$

$$= \frac{4 \times (4 \times 10^6 - 0)}{100 \times 10^{-3}}$$

$$= \frac{16 \times 106}{100 \times 10^{-3}} = 160 \text{ mega}$$

113. (3) Between P and R, a series combination of two capacitances in parallel with a series combination of three capacitance. Thus equivalent capacitance between P and R is

$$C_{Pr} = \frac{C}{3} + \frac{C}{2} = \frac{5C}{6}$$

Similarly between P and Q, a parallel combination of one capacitance with a series combination of four capacitance

Thus $$C_{PQ} = C + \frac{C}{4} = \frac{5C}{4}$$

So $$\frac{C_{PR}}{C_{PQ}} = \frac{4}{6} = \frac{2}{3}$$

114. (1) For a circular wave, the amplitude of the wave varies as $A \propto r^{-1/2}$

115. (4) In the inelastic collision between two spherical rigid bodies, the linear momentum is conserved but not the kinetic energy

116. (2) When a p–n diode is reverse biased, then the depletion region of the p–n diode is increased

117. (1) When the multiplication factor has a value less than 1, then the operation of the nuclear reactor is said to be critical

118. (2)

119. (1) The output = product of inputs

120. (3) To move a load with constant velocity, first the force is used to overcome the stastic friction and then the body keeps on moving with constant velocity even when the force has been decreased.

121. (2) The black object will glow the brightest

122. (2) It it is assumed the balloons have same volume, so using $PV = nRT$, and given is P, T are same, so 'n' is also same

123. (4) As the battery wears out the filament shows red colour though if there is no significant change in voltage, colour remains the same but its intensity decreases.

124. (1) The lines of forces move out from a positive charge and go into a negative charge.

125. (1) The magnetic field due to a circular loop at its centre is $B' = \frac{\mu_0}{4\pi}\frac{2\pi I_C}{R}$ and that due to a straight line at the centre of the loop is $B'' = \frac{\mu_0 \times 2 I_C}{4\pi H}$

so $B = B' - B'' = 0$

so $H = I_C R / \pi I_C$

126. (1) The moment of the tension about the is maximum in A and it counter balances the moment of mg acting from the centre of the rod.

127. (2) The emission of an α particle is followed by

(i) Decrease in mass number = 238 – 4 = 234

(ii) Decrease in atomic number = 92 – 2 = 90

So $^{234}_{90}Th$ is emitted.

128. (3) Given the amount of C^{14} remaining is $\frac{1}{2}$ of origin after 5730 years. So the have $\frac{1}{16}$ th of original value, it takes $\left(\frac{1}{2}\right)^4$

$\Rightarrow 4 \times 5730 = 22920$ years.

129. (3) By conservation of mass number and charge no. $^{23}_{11}Na$ and $^{1}_{1}H$ is the right answer.

130. (1) For beats of 5Hz, 440 Hz tuning fork is used for beats of 8Hz, 432 Hz tuning fork is used so 445 Hz is the correct small.

131. (2) (i) When the ring enters the magnetic field the emf is induced and current flows in one direction

(ii) When the ring is inside the filled, there is no change in flux.

(iii) When the ring gas out, the current is in opposite direction to that in (i)

132. (4) For α and β, the wavelength will be de Broglie wavelength and for γ waves, the wavelength would be that of electromagnetic waves.

133. (2) The voltage gain in dB = $20 \log_{10} A_v$

$= 20 \log_{10} (1000) = 20 \times 3 = 60$ B

134. (3) When water is converted to ice, entropy decreases.

135. (2) In cold bath, length of x decreases more, so it moves towards left.

136. (3) For a wave propagating in a medium the frequency is independent

137. (2) If an object reflects the colour of light incident on it, it will appear with that colour but if object absorbs the colour of light, it will appear to be black. Since, the given wavelength does not belong to green, so it will be absorbed by the leaf and hence, it will appear to be black.

138. The voltage across its ends = 2 v

so the pet. drop across R = 6 – 2 = 4v

Current flowing = 10 mA

$$\text{So } R = \frac{4}{10 \times 10^{-3}} = 400\ \Omega$$

139. (1) The potential difference between base and emitter is 1V

140. (4) For the demodulation to be good, $RC >> \frac{1}{f}$.

141. (d) CPR : cardiopulmonary resuscitation, a combination of rescue breathing (mouth-to-mouth resuscitation) and chest compressions. If a child isn't breathing or circulating blood adequately, CPR can restore circulation of oxygen-rich blood to the brain. Without oxygen, permanent brain damage or death can occur in less than 8 minutes.

142. (4) Alzheimer's (AHLZ-high-merz) disease is a progressive brain disorder that gradually destroys a person's memory and ability to learn, reason, make judgments, communicate and carry out daily activities. It is common in elderly people.

143. (1) The Govt. of India after having recognized the need for systematic Research and Development of Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homoeopathy in the country, established the "Central Council for Research in Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homoeopathy" in 1969 as an autonomous organization under the Ministry of Health and Family Welfare, 61-65, Institutional Area, Janakpuri, Phankha Road, New Delhi-110058

144. (4) The term pneumonia refers to any infection of the lung. The "pneumonia vaccine" is given to prevent one specific type of pneumonia--the pneumonia caused by the Pneumococcus (*Streptococcus pneumoniae*) bacterium. Vaccination for pneumonia is not covered in the immunization schedule so far in India.

DTaP is an acronym for the combined diphtheria, tetanus, and acellular pertussis vaccine. The "a" denotes the vaccine's acellular pertussis components, distinguishing it from whole-cell, inactivated DTP (aka DTwP) vaccine. The acellular vaccine uses antigenic fragments of the pertussis pathogen to induce immunity

MMR/Measles Vaccine is given for protection against measles, the typical fever with rash of childhood

145. (1) It is an old wives' tale. Really. Try it with 100 cucumbers and not on another 100 if you don't believe me. Some cucumbers can be bitter, especially at the ends, and you might want to cut off the ends because of this. In particular, cut off the blossom end of fresh cucumbers, as the blossoms contain enzymes that are bitter and others that cause excessive softening of pickles.

You can draw out the bitterness in the rest of the cucumber by slicing, salting, and draining it before adding to a salad. This works on the principle of osmosis. The principle of bitterness spontaneously leaving the cucumber because you rubbed the end... well, it does no harm, so do it if you want.

146. (1) Rustom Jal Vakil returned to India in 1938 after earning his medical degree from the University of London and focused on the treatment of heart ailments at a time when cardiology was not a distinct subspecialty in India. In 1949, after years of scrupulous collation and analysis of data, he published a watershed paper on the antihypertensive properties of Rauwolfia serpentina and effected a paradigm shift in the management of hypertension. Rauwolfia was the world's 1st successful blood-pressure-lowering agent, and its acceptance encouraged research scientists to pursue the development of other hypotensive drugs. Reserpine was isolated in 1952 from the dried root of *Rauwolfia serpentina* (Indian snakeroot), and introduced in 1954, two years after chlorpromazine. Reserpine almost irreversibly blocks the uptake (and storage) of noradrenaline and dopamine into synaptic vesicles by inhibiting the Vesicular Monoamine Transporters (VMAT).

Paul Ehrlich (March 14, 1854 – August 20, 1915) was a German scientist who won the 1908 Nobel Prize in Physiology or Medicine. He is noted for his work in hematology, immunology, and chemotherapy. Ehrlich predicted autoimmunity and called it "horror autotoxicus". He coined the term "chemotherapy". The idea of a "magic bullet" is also his, and he is credited with the first empirical observation of the blood-brain barrier.

147. (2) Biometry or biometrics is simply defined as automatically recognizing a person using distinguishing traits. Biometric identification uses some unique physiological or behavioural characteristic, not shared by any other individual, to positively identify an individual.

148. (2) Each day after the winter solstice, which occurs on December 21st, the Sun's path becomes a little higher in the southern sky. The Sun also begins to rise closer to the east and set closer to the west until we reach the day when it rises exactly east and sets exactly west. This day is called the equinox. In the spring we have the Spring Equinox about March 21st. There is also a Fall Equinox on September 21st

149. (1) In late 1895, a German physicist, W.C. Roentgen while working with a cathode ray tube in his laboratory discovered X-rays.

150. (2)

151.(3) Directly Observed Therapy Shortcourse (DOTS) is the internationally-recommended TB control strategy and is composed of five distinct elements: political commitment; microscopy services; drug supplies; surveillance and monitoring systems and use of highly efficacious regimens; and direct observation of treatment.

152. (4) **153.** (1) **154.** (2) **155.** (3) **156.**(1) **157.** (1) **158.** (1) **159.** (2) **160.** (2)

161. (2) The autonomic nervous system (ANS) is the part of the nervous system of the higher life forms that is not consciously controlled. It is commonly divided into two usually antagonistic subsystems: the sympathetic and parasympathetic nervous system, and involves the homeostasis of organs and physiological functions.

A third and less commonly considered part of the autonomic nervous system is the enteric nervous system, which controls the digestive organs, and is, for the most part, independent of central nervous system (CNS) input.

In general, the parasympathetic nervous system is involved with digestion and energy conservation, while the sympathetic nervous system is involved with energy expenditure and the 'fight or flight' response.

Here is a summary of some of the effects of sympathetic and parasympathetic stimulation. Notice that effects are generally in opposition to each other.

The Autonomic Nervous System

Structure	Sympathetic Stimulation	Parasympathetic Stimulation
Iris (eye muscle)	Pupil dilation	Pupil constriction
Salivary Glands	Saliva production reduced	Saliva production increased
Oral/Nasal Mucosa	Mucus production reduced	Mucus production increased
Heart	Heart rate and force increased	Heart rate and force decreased
Lung	Bronchial muscle relaxed	Bronchial muscle contracted
Stomach	Peristalsis reduced	Gastric juice secreted; motility increased
Small Intestine	Motility reduced	Digestion increased
Large Intestine	Motility reduced	Secretions and motility increased
Kidney	Decreased urine secretion	Increased urine secretion
Liver	Increased conversion of glycogen to glucose	
Adrenal medulla	Norepinephrine and epinephrine secreted	
Bladder	Wall relaxed	Wall contracted
	Sphincter closed	Sphincter relaxed

It should be noted that the autonomic nervous system is always working. It is NOT only active during "fight or flight" or "rest and digest" situations. Rather, the autonomic nervous system acts to maintain normal internal functions and works with the somatic nervous system.

162. (2) **'The Duckbill Platypus'** are mammals because the females produce milk and nurse their young; however they are different as the Duckbill platypus, strangely lays eggs. This makes the Duckbill Platypus one of only three Monotremata that walk this earth. Originating from the word monotreme, which means a "single whole or opening", Monotremata are mammals that lay eggs. The Duckbill platypus is a mammal that lays eggs.

(1) Despite their name (which means "thousand legs"), millipedes do not have 1,000 legs - they have from 47 to 197 pairs of legs, depending on the species. Millipedes are invertebrates; they have a hard exoskeleton and many jointed legs. The nervous system comprises a three-part brain, with a nerve cord running the body's length, with bundles of coordination nerves. Classification: Kingdom Animalia (animals), Phylum Arthropoda (jointed legs and an exoskeleton), Superclass Myriapoda ("many-footed" with a 2-segmented body - millipedes, centipedes, etc.), Class Diplopoda (millipedes). About 7,500 species of millipedes have been described.

(3) Lepisma saccharina
Phylum: Arthropoda
Class: Insecta
Order: Thysanura
Family: Lepismatidae
Genus: Lepisma
Species: L. saccharina

Lepisma saccharina (commonly called the fish-moth, urban silverfish or just the silverfish) is a small, wingless insect. Its common name derives from the animal's silvery grey colour, while the scientific name indicates the silver-

fish's diet of carbohydrates such as sugar or starches. It belongs to the basal insect order Thysanura, and the species is estimated to have existed for 300 million years.

(4) Sea anemone are Diploblastic: having a body made of two cellular layers only (as opposed to the majority of animals which are triploblastic), the exterior ectoderm and the interior endoderm. These two layers are separated by the largely non-cellular jelly-like mesogloea.
Classification : Kingdom Animalia (animals), Phylum Coelenterata (corals, jellyfish, sea anemones, hydroids), Class Anthozoa meaning "flower-like animals" (corals and sea anemones), Order Actiniaria

63. (4) muscular diaphragm and milk producing glands.

(1) monotremes are oviparous

(2) Elephants are one of the exceptions to the rule that mammals have extra-abdominal testes; so are whales and perhaps other marine mammals.

(3) All mammals except the monotremes, the edentates, the pangolins, and the cetaceans have up to four distinct types of teeth, with a maximum number for each. These are the incisor *(cutting)*, the canine, the premolar, and the molar *(grinding)*. Mammals that have distinct types of teeth are heterodont; others are homodont.
Mouth with diphyodont teeth (milk, or deciduous, teeth replaced by a permanent set of teeth); teeth in most spp. are heterodont (teeth with various structures and functions; lower jaw a single enlarged bone (dentary).

General Characteristics of Mammals

1. Body covered with hair, but reduced in some spp..
2. Integument with sweat, scent, sebaceous, and mammary glands.
3. Skeletal features include:
   a. skull with
   I. bony palate
   II. middle ear with three ossicles (malleus, incus, and stapes)
   b. Seven cervical vertebrae
   c. Fused pelvic bones.
5. Movable eyelids and fleshy external ears
6. Four limbs (reduced or absent in some spp.) adapted for many forms of locomotion.
7. Circulatory system of 4-chambered heart, nonnucleated RBC's, and biconcave RBC's.
8. Respiratory system of lungs with alveoli, and voice box (larynx); a secondary bony palate separates air and food passages; muscular diaphragm separates thoracic and abdominal cavities.
9. Excretory system of metanephric kidneys and ureters that usually open into a bladder.
10. Brain highly developed; 12 pairs of cranial nerves.
11. Strictly endothermic homeotherms.
12. Cloaca present only in monotremes (egg-laying mammals, such as duck-billed platypus).
13. Separate sexes; specialized reproductive and copulatory organs.
14. Internal fertilization; egg develops in a uterus with placental attachment (except in monotremes); fetal membranes (amnion, chorion, allantois); sex determination by heterogametic males (females are isogametic).
15. Young are nourished by milk from mammary glands.

164. (1) **Parietal cells** (also called oxyntic cells) are cells located in the stomach epithelium.
Parietal cells contain an extensive secretory network (called canaliculi) from which the HCl is secreted by active transport into the stomach. The enzyme hydrogen potassium ATPase (H^+/K^+ ATPase) is unique to the parietal cells and transports the H^+ against a concentration gradient of about 3 million to 1.

(2) Alpha cells are located in the islets of Langerhans in the pancreas; they produce the hormone glucagon, which causes an increase in the blood sugar level.

(3) Kupffer cells are macrophages that are attached to the luminal surface or inserted in the endothelial lining of hepatic sinusoids. In this site, Kupffer cells play a key role in host defense by removing foreign, toxic and infective substances from the portal blood and by releasing beneficial mediators.

(4) The sebaceous glands are holocrine glands found in the skin of mammals. They secrete an oily substance called sebum (Latin, meaning *fat* or *tallow*) that is made of fat (lipids) and the debris of dead fat-producing cells. These glands exist in humans throughout the skin except in the palms of the hands and soles of the feet. Sebum acts to protect and waterproof hair and skin, and keep them from becoming dry, brittle, and cracked. It can also inhibit the growth of microorganisms on skin.

165. (2) There are two types of photoreceptors in the human retina, rods and cones.
Rods are responsible for vision at low light levels (scotopic vision). They do not mediate color vision, and have a low spatial acuity.
Cones are active at higher light levels (photopic vision), are capable of color vision and are responsi-

ble for high spatial acuity. The central fovea is populated exclusively by cones. There are 3 types of cones which we will refer to as the short-wavelength sensitive cones, the middle-wavelength sensitive cones and the long-wavelength sensitive cones or S-cone, M-cones, and L-cones for short.

The light levels where both are operational are called mesopic

166. (1). **Polygenic inheritance** is a pattern responsible for many features that seem simple on the surface. Many traits such as height, shape, weight, color, and metabolic rate are governed by the cumulative effects of many genes. Polygenic traits are not expressed as absolute or discrete characters, as was the case with Mendel's pea plant traits. Instead, polygenic traits are recognizable by their expression as a gradation of small differences (a continuous variation).

167. (2) A **test cross** determines whether a particular characteristic of a plant or animal is homozygous dominant (pure bred) or heterozygous dominant (hybrid)

When you look at someone with a dominant trait, you can't tell whether they are homozygous or heterozygous. For instance, if someone has brown eyes, they could be BB or Bb. Mendel always started his crosses with a purebred (homozygous) P generation. How did he know his dominant parent was homozygous? He developed what is known as a test cross. He took a recessive (in our case blue eyes, or bb) and mated it with a pea plant showing the dominant trait. If in the F_1 generation the offspring were all dominant, then the dominant parent was probably BB. If there were any recessives in the F_1, then the dominant parent had to be Bb.

168.. (3) **Rennin** is a coagulating enzyme occurring in the gastric juice of the calf, forming the active principle of rennet and able to curdle milk.

Helicase is an enzyme that is capable of unwinding the double helix structure of DNA.

Hyaluronidase: An enzyme that catalyzes the breakdown of hyaluronic acid in the body, thereby increasing tissue permeability to fluids. Also called spreading factor.

By catalyzing the hydrolysis of hyaluronic acid, a major constituent of the interstitial barrier, hyaluronidase lowers the viscosity of hyaluronic acid, thereby increasing tissue permeability. It is, therefore, used in medicine in conjunction with other drugs in order to speed their dispersion and delivery. The most common application is in ophthalmic surgery, in which it is used in combination with local anesthetics. It also increases the absorption rate of parenteral fluids given by hypodermoclysis, and is an adjunct in subcutaneous urography for improving resorption of radiopaque agents.

(1) **Lysine** is an essential amino acid, which means that it is essential to human health but cannot be manufactured by the body. For this reason, lysine must be obtained from food.

Glycine is a non-essential, neutral, genetically coded amino acid. It is the only protein-forming amino acid without a center of chirality

Thiamine is one of the B vitamins, a group of water-soluble vitamins that participate in many of the chemical reactions in the body.

(2) **Myocin** is one of the major proteins of muscle. Myosin can slide along filaments of actin, generating force as it does so and using ATP as its motive energy source

Oxytocin is a hormone produced by the pituitary gland that stimulates contractions of the uterus during labor and release of milk during breast-feeding.

Gastrin is a polypeptide hormone secreted by the mucous lining of the stomach; induces the secretion of gastric juice

(4) **Sensory** nerve is a nerve that passes impulses from receptors toward or to the central nervous system. Optic nerve is the largest sensory nerve of the eye; carries impulses for sight from the retina to the brain

Oculomotor is a motor nerve and is the third of twelve paired cranial nerves. It controls most of the eye movements (cranical nerves IV and VI also do some), constriction of the pupil, and holding the eyelid open

Vagus is a mixed nerve that supplies the pharynx and larynx and lungs and heart and esophagus and stomach and most of the abdominal viscera

169. (4) **Human leg bones** : trochanter, femur, patella, tibia, fibula, tarsals, metatarsals & phalanges.

170. (3) **Haemophilia** : A disease in which the blood fails to clot. The most common form, primarily affecting males, is caused by a mutation in a gene coding for a clotting protein (factor VIII) inherited as an X-linked recessive phenotype. Red green colour blindness is also a sex linked recessive disease (recessive gene on X chromosome).

171. (4) **Chameleons** (family Chamaeleonidae) are squamates that belong to one of the best known families. They are known for their ability to change their color, their elongated sticky tongue, and for their eyes which can be moved independently of each other. The name "chameleon" means "earth lion" and is derived from the Greek words "chama (on the ground, on the earth) and "leon" (lion).

172. (1) Enzymes are catalysts. Most are proteins. Enzymes bind temporarily to one or more of the reactants of the reaction they catalyze. In doing so, the lower the amount of activation energy needed and thus speed up the reaction. In the given graph curve a shouws normal enzyme reaction, curve b

shows competitive inhibition and curve c shows non-competitive inhibition.

173. (2) Best way to make use of biodegradable pollutants is to use them for producing biogas.

174. (1) **Borderline personality disorder** - It is a type of psychological disorders in which person is emotionally unstable. They have little sense of self since they feel empty.

A mood disorder is a condition whereby the prevailing emotional mood is distorted or inappropriate to the circumstances.

The two major types of mood disorders are *depression* (or unipolar depression) and bipolar disorder.

Depression (or unipolar depression), including subtypes:

Major Depression

Major Depression (Recurrent)

Major Depression with psychotic symptoms (*psychotic depression*)

Dysthymia

Postpartum depression

Bipolar disorder, a mood disorder described by alternating periods of mania and depression (and in some cases rapid cycling, mixed states, and psychotic symptoms symptoms). Subtypes include:

Schizophrenia is a mental disorder. It difficult for a person to tell the difference between real and unreal experiences, to think logically, to have normal emotional responses to others, and to behave normally in social situations.

175. (1) **Mitochondria** have their own genetic material however, and, in sexually reproducing organisms, are inherited only via the cytoplasm of the egg cell

176. (3) These are **simple columnar epithelial** cells, but in addition, they posses fine hair-like outgrowths, cilia on their free surfaces. These cilia are capable of rapid, rhythmic, wavelike beatings in a certain direction. This movement of the cilia in a certain direction causes the mucus, which is secreted by the goblet cells, to move (flow or stream) in that direction. Ciliated epithelium is usually found in the air passages like the nose. It is also found in the uterus and Fallopian tubes of females. The movement of the cilia propel the ovum to the uterus.

177. (2) Tadpoles treated with **thyroxine** (thyroid hormone) or iodine will develop at an increased rate, whereas tadpoles treated with thiourea, a thyroid-hormone inhibitor, will metamorphose at a slower rate. Furthermore, a higher concentration of thyroxine will be more effective at speeding metamorphosis than a lower concentration.

Xenopus laevis tadpoles that arrest development and remain as larvae for several years sometimes occur spontaneously in laboratory populations. These tadpoles cease development at an early hindlimb stage, but continue to grow and develop into grossly deformed giants. Giant tadpoles lack thyroid glands, and differ in morphology and behaviour from normal larvae. They are negatively buoyant, typically with small and partially solidified lungs, and have greatly enlarged fat bodies. Giant tadpoles have mature gonads with eggs and sperm, whereas normal tadpoles of the same stage have undifferentiated gonads. Larval reproduction has never been reported in anurans, but gonadal development decoupled from metamorphosis brings these giants the closest of any anurans to being truly neotenic. We discuss behavioural and morphological factors that may hinder both reproduction in giant *Xenopus* larvae and the evolution of neoteny in anurans in general. Experimental treatment with exogenous thyroid hormone induces some, but not complete, metamorphic changes in these giants. The limbs and head progress through metamorphosis; however, all tadpoles die at the stage when the tail would normally be resorbed. The disproportionate growth of tissues and organs in giant tadpoles may preclude complete metamorphosis, even under exogenous thyroid hormone induction.

178. (1) **Bilharzia** is a human disease caused by parasitic worms called Schistosomes. Over one billion humans are at risk worldwide and approximately 300 millions are infected. Bilharzia is common in the tropics where ponds, streams and irrigation canals harbor bilharzia-transmitting snails. Parasite larvae develop in snails from which they infect humans, their definitive host, in which they mature and reproduce.

Leptospirosis is a potentially serious illness that can affect many parts of the body. Leptospirosis is caused by *Leptospira interrogans*, a corkscrew-shaped bacterium (spirochete). Leptospirosis-causing bacteria are common worldwide, especially in tropical countries with heavy rainfall. Infected rodents and other wild and domestic animals pass the bacteria in their urine. The bacteria can live for a long time in fresh water, damp soil, vegetation, and mud. Flooding after heavy rainfall helps spread the bacteria in the environment. People get leptospirosis by contact with fresh water, damp soil, or vegetation contaminated by the urine of infected animals. People who canoe, raft, wade, or swim in contaminated lakes, rivers, and streams can get leptospirosis. Leptospirosis is also a problem for people who work in contaminated flood plains or wet agricultural settings. Leptospirosis bacteria can enter the body through broken skin and mucous membranes. The bacteria can also enter the body when a person swallows contaminated food or water, including water swallowed during water sports. Once in the bloodstream, the bacteria can

reach all parts of the body and cause signs and symptoms of illness

Hepatitis A is an inflammation of the liver caused by a virus, the hepatitis A virus (HAV). It varies in severity, running an acute course, generally starting within two to six weeks after contact with the virus, and lasting no longer than two or three months. HAV may occur in single cases after contact with an infected relative or sex partner. Alternately, epidemics may develop when food or drinking water is contaminated by the feces of an infected person.

Diarrhoea : Diarrhoea is a symptom of infection caused by a host of bacterial, viral and parasitic organisms most of which can be spread by contaminated water. It is more common when there is a shortage of clean water for drinking, cooking and cleaning and basic hygiene is important in prevention. Water contaminated with human faeces for example from municipal sewage, septic tanks and latrines is of special concern. Animal faeces also contain microorganisms that can cause diarrhoea. Diarrhoea can also spread from person to person, aggravated by poor personal hygiene. Food is another major cause of diarrhoea when it is prepared or stored in unhygienic conditions. Water can contaminate food during irrigation, and fish and seafood from polluted water may also contribute to the disease.

Guinea worm infection : Infection occurs when the parasitic guinea worm resides within the body. Infection is not apparent until a pregnant female worm prepares to expel embryos. The infection is rarely fatal, but the latter stage is painful. The infection is also referred to as dracunculiasis, and less commonly as drecontiasis.

Ffilariasis :The thread-like, parasitic filarial worms *Wuchereria bancrofti* and *Brugia malayi* that cause lymphatic filariasis live almost exclusively in humans. These worms lodge in the lymphatic system, the network of nodes and vessels that maintain the delicate fluid balance between the tissues and blood and are an essential component for the body's immune defence system. They live for 4-6 years, producing millions of immature microfilariae (minute larvae) that circulate in the blood.

The disease is transmitted by mosquitoes that bite infected humans and pick up the microfilariae that develop, inside the mosquito, into the infective stage in a process that usually takes 7-21 days. The larvae. then migrate to the mosquitoes' biting mouth-parts, ready to enter the punctured skin following the mosquito bite, thus completing the cycle.

Amoebic dysentery (amoebiasis) is an infection of the intestine (gut) caused by an amoeba called Entamoeba histolytica, which, among other things, can cause . Amoebae are parasites that are found in contaminated food or drink. They enter the body through the mouth when the contaminated food or drink is swallowed. The amoebae are then able to move through the digestive system and take up residence in the intestine and cause an infection. Amoebic dysentery is passed on by careless or negligent hygiene where contaminated food and drink is consumed without adequate heat treatment.

Salads washed with contaminated water are a common method of spread.

179. (2) The **Maximum Contaminant Level** (MCL) of nitrate as nitrogen (NO3-N) at 10 mg/L (or 10 parts per million) for the safety of drinking water. Nitrate levels at or above this level have been known to cause a potentially fatal blood disorder in infants under six months of age called methemoglobinemia or "blue-baby" syndrome; in which there is a reduction in the oxygen-carrying capacity of blood.

Pneumoconiosis is a lung condition that is caused by inhaling particles of mineral dust, usually while working in a high-risk, mineral-related industry. At first, irritating mineral dust can trigger lung inflammation, which causes areas of the lung to be temporarily damaged. Over time, these areas can progress to form tough, fibrous tissue deposits. This stage of pneumoconiosis is called fibrosis. Fibrosis stiffens the lungs and interferes with the lung's normal exchange of oxygen and carbon dioxide. . Coal worker's pneumoconiosis is a respiratory disease caused by inhaling coal dust for prolonged periods (Black lung disease)

Non-Hodgkin's lymphoma is cancer that originates in lymphatic system, the disease-fighting network spread throughout the body. In non-Hodgkin's lymphoma, tumors develop from white blood cells (lymphocytes). These tumors can occur at different locations in the body. There are more than 30 types of non-Hodgkin's lymphoma. Non-Hodgkin's lymphoma is more than seven times as common as the other general type of lymphoma — Hodgkin's disease Causes. Normally, white blood cells (lymphocytes) go through a predictable life cycle. Old lymphocytes die, and body creates new ones to replace them. But in non-Hodgkin's lymphoma, body produces abnormal lymphocytes that continue to divide and grow uncontrollably. This oversupply of lymphocytes crowds into lymph nodes, causing them to swell. Doctors don't know what exactly causes non-Hodgkin's lymphoma. But researchers believe that activation of certain abnormal genes may be involved in the development of all cancers, including lymphomas.

Methane being a green house gas has direct effect on ozone depletion (cause of skin cancers) Exposure to asbestos, a group of minerals found in

housing and industrial building materials can cause a variety of medical problems, such as Mesothelioma.

Studies have shown that people who are exposed to high amount of benzene are at risk for cancer. Benzene is a chemical found in gasoline, smoking, and pollution. Often called the "asbestos cancer", Mesothelioma is a disease affecting the abdomen, chest and areas around the heart

180. (2) A **coronary angiogram** is a special type of X-ray which looks at the blood vessels of the heart. If you have angina or have had a recent heart attack you may be asked to undergo this test. Normal X-rays would not show up blood vessels. A type of dye called 'contrast' is injected into the blood vessels of the heart that allows us to see them clearly. The catheter (a thin long length of plastic tubing), which is used to deliver the contrast 'dye' to the heart, is inserted via a large blood vessel in the groin. You will have this area cleaned and a local anaesthetic drug will be injected into the skin so that you do not feel any pain. Once this drug has been injected you will feel pressure and 'tugging' at the site but no pain. The catheter is passed through a large blood vessel in the groin or arm all the way up to the coronary arteries. You may be asked to hold your breath or cough during this procedure. Once the operator enters the blood vessels of the heart a small amount of contrast will be injected so that the blood vessels show up on the X-rays. Rarely this may cause some discomfort in the chest.

181.. (3) **BRINJAL** (*Solanaum melongena*) is susceptible to nematode invasion due to multiple cropping pattern, good moisture level prevailing and continued presence of host. Rootknot caused by meloidogyne incognita is the most destructive nematode

Potato late blight is one of the most devastating plant diseases. Potato late blight, caused by *Phytophthora infestans*

Citrus canker is a highly contagious disease of citrus crops caused by the bacterium Xanthomonas axonopodis pathovar citri.

Pigeon pea cyst nematode -Heterodera cajani

182. (4) The basic chromosome number of wheat is 7 (x =7) and its hexaploid species contains 42 (6 x 7) chromosomes. Thus, it's monosomic (one chromosome missing) contains 41 (42 – 1) chromosomes, haploid 21 (42/2) chromosomes. Nullisomic (one chromosome pair missing) contains 40 (40 – 2) chromosomes and trisomic contains (42 + 1) chromosomes.

183. (2). **Grafting** is a method of plant propagation widely used in horticulture, where the tissues of one plant are encouraged to fuse with those of another. It is most commonly used for the propagation of trees and shrubs grown commercially. (Grafting is limited to dicots and gymnosperms. Monocots lack the vascular cambium required.)

In most cases, one plant is selected for its roots, and this is called the stock or rootstock. The other plant is selected for its stems, leaves, flowers, or fruits and is called the **scion.**

In stem grafting, a common grafting method, a shoot of a selected, desired plant cultivar is grafted onto the stock of another type. In another common form called budding, a dormant side bud is grafted on the stem of another stock plant, and when it has fused successfully, it is encouraged to grow by cutting out the stem above the new bud.

For successful grafting to take place, the vascular cambium tissues of the stock and scion plants must be placed in contact with each other. Both tissues must be kept alive till the graft has taken, usually a period of a few weeks. Successful grafting only requires that a vascular connection takes place between the two tissues. A physical weak point often still occurs at the graft, because the structural tissue of the two distinct plants, such as wood may not fuse.

184. (4) Evert concluded that the most likely function of P-protein is to seal the sieve plate pores of injured sieve elements as a rapid first line of defense.

185. (2) **Myxomycetes** *also called Mycetozoa*, phylum of funguslike organisms within the kingdom Protista, commonly known as true slime molds. They exhibit characteristics of both protozoans (one-celled microorganisms) and fungi. Distributed worldwide, they usually occur in decaying plant material

186. (4) **Benthan and Hooker** did not know the affinities of the families placed under series viii. Ordines anomaly and the families were tentatively grouped together.

DICOTYLEDONES

1. POLYPETALAE
   - Series i. THALAMIFLORAE
   - Series ii. DISCIFLORAE
   - Series iii. CALYCIFLORAE
2. GAMOPETALAE
   - Series i. INFERAE
   - Series ii. HETEROMERAE
   - Series iii. BICARPELLATAE
3. MONOCHLAMYDEA E
   - Series i. CURVEMBRYEAE
   - Series ii. MULTIOVULATAE AQUATICAE
   - Series iii. MULTIOVULATAE TERRESTRES
   - Series iv. MICREMBRYEAE
   - Series v. DAPHNALES
   - Series vi. ACHLAMYDOSPOREAE
   - Series vii. UNISEXUALES
   - **Series viii. ORDINES ANOMALI**

187. (3) **Hirudin:** An anticoagulant ("bloodthinner"). Hirudin is the active principle in the salivary secretion of leeches. The name hirudin is from Hirudo medicinalis, the name of the medicinal leech. In 1884 John Haycraft in Strasbourg found that leeches contained a substance with anticoagulant properties. This anticoagulant in leech saliva was isolated in the 1950s and found to be an antithrombin (an inhibitor of thrombin). The primary chemical structure of hirudin was determined in 1976. Hirudin is produced from transgenic *Brassica napus*.

188. (2) The **graft consists** of a top portion (the scion), which is the desired plant, growing on the roots of another plant (the stock). The quality of flowers and fruits of such a composite plant produced is mainly determined by scion. (also refer Ans. 183)

189. (4) Present in photosynthetic bacterian and blue green algae, chromatophore is a simple body that lacks the complex internal structure and chemically simpler than chlorophyll of plants.

190. (4) In fungi, a large sporophore, or fruiting body, in which sexually produced spores are formed on the surface of club-shaped structures (basidia). Basidiocarps are found among the members of the class Basidiomycetes (*q.v.*), with the exception of the rust and smut fungi. The largest basidiocarps include giant puffballs (*Calvatia gigantea*), which can be 1.6 m (5.25 feet) long, 1.35 m broad

191. (4) **Leghaemoglobin** : Form of haemoglobin found in the nitrogen-fixing root-nodules of legumes. Binds oxygen, and thus protects the nitrogen-fixing enzyme, nitrogenase, that is oxygen sensitive.

192. (1) The ***Avena* geo-curvature** test is a bioassay for auxin-type growth regulators. Measurement of the effect of a known or suspected biologically active substance on living material is called as bioassay. Avena curvature test was first time performed by Went for measuring the activity fo auxin hormone.

193. (4) New **Plastids** arise from **preexisting plastids** by a fission like process.

194. (3) Salvia, Calotropis and Mussanda are insect pollinating flowers
Kadam and Kigelia are bat pollinating flowers
Triticum, Zea mays, Cannabis and Pinus are wind pollinating flowers.

195. (3) Montreal Protocol (16 september 1987) 27 industrialised countries agreed to limit production of chlorofluorocarbons to half the level of 1986. Montreal protocol limits the production and use of ozone depleting substances such as CFCs.To date more than 175 countries have signed the montreal protocol.

196. (4) A **keystone species** is a species whose very presence contributes to a diversity of life and whose extinction would consequently lead to the extinction of other forms of life. Keystone species help to support the ecosystem (entire community of life) of which they are a part.

197. (3) **Genetic diversity** is a characteristic of ecosystems and gene pools that describes an attribute which is commonly held to be advantageous for survival -- that there are many different versions of otherwise similar organisms. For example, the Irish potato famine can be attributed in part to the fact that there were so few different genetic strains of potatoes in the country, making it easier for one virus to infect and kill much of the crop.

198. (3) RNA synthesis continues until RNA polymerase reaches a site on the DNA called the **terminator or non-sence codons**. Non-sense codons signal the end of protein molecule's synthesis (UAA, UAG, UGA)

199. (2) A **biosphere** reserve is a large area protected for its 'natural' beauty this may include the various plants, the animals feeding on the plants and the primary hunters who in turn feed on the herbivores (although man is a part of the biosphere none have been housed in reserves till date!). National parks are much the same except for the fact that they are usually smaller in size. The origin of the word sanctuary comes from the word sanctuarium (Latin origin). It means "a place of safety for injured or hurt animals". Here the animals recoup their numbers away from their "inhuman human enemies

200. (1) **Somaclonal variation** is the term used to describe the variation seen in plants that have been produced by plant tissue culture. Chromosomal rearrangements are an important source of this variation. Somaclonal variation is not restricted to, but is particularly common in plants regenerated from callus. The variations can be genotypic or phenotypic, which in the later case can be either genetic or epigenetic in origin. Typical genetic alterations are: changes in chromosome numbers (polyploidy and aneuploidy), chromosome structure (translocations, deletions and duplications) and DNA sequence (base mutations). Typical epigenetic related events are: gene amplification and gene methylation.