

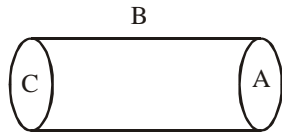
CBSE PMT – 2007 SCREENING

PHYSICS

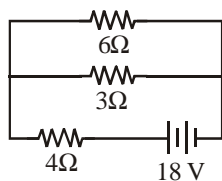
1. The primary and secondary coil of a transformer have 50 and 1500 turns respectively. If the magnetic flux ϕ linked with the primary coil is given by $\phi = \phi_0 + 4t$, where ϕ is in webers, t is time in seconds and ϕ_0 is a constant, the output voltage across the secondary coil is
 - (a) 120 volts
 - (b) 220 volts
 - (c) 30 volts
 - (d) 90 volts
2. A beam of electron passes undeflected through mutually perpendicular electric and magnetic fields. If the electric field is switched off, and the same magnetic field is maintained, the electrons move
 - (a) in a circular orbit
 - (b) along a parabolic path
 - (c) along a straight line
 - (d) in an elliptical orbit.
3. The position x of a particle with respect to time t along x -axis is given by $x = 9t^2 - t^3$ where x is in metres and t in second. What will be the position of this particle when it achieves maximum speed along the +ve x direction?
 - (a) 54m
 - (b) 81m
 - (c) 24m
 - (d) 32m.
4. A particle starting from the origin $(0, 0)$ moves in a straight line in the (x, y) plane. Its coordinates at a later time are $(\sqrt{3}, 3)$. The path of the particle makes with the x -axis an angle of
 - (a) 45°
 - (b) 60°
 - (c) 0°
 - (d) 30°
5. A car moves from X to Y with a uniform speed v_u and returns to X with a uniform speed v_d . The average speed for this round trip is
 - (a) $\sqrt{v_u v_d}$
 - (b) $\frac{v_d v_u}{v_d + v_u}$
 - (c) $\frac{v_u + v_d}{2}$
 - (d) $\frac{2v_d v_u}{v_d + v_u}$.
6. Two radioactive substances A and B have decay constants 5λ and λ respectively. At $t = 0$ they have the same number of nuclei. The ratio of number of nuclei of A to those of B will be $(1/e)^2$ after a time interval
 - (a) 4λ
 - (b) 2λ
 - (c) $1/2\lambda$
 - (d) $1/4\lambda$
7. In the following circuit, the output Y for all possible inputs A and B is expressed by the truth table

<ol style="list-style-type: none"> (a) A B Y 0 1 1 0 1 1 1 0 1 1 1 0 	<ol style="list-style-type: none"> (b) A B Y 0 0 1 0 1 0 1 0 0 1 1 0
<ol style="list-style-type: none"> (c) A B Y 0 0 0 0 1 1 1 0 1 1 1 1 	<ol style="list-style-type: none"> (d) A B Y 0 0 0 0 1 0 1 0 0 1 1 1
8. In a radioactive decay process, the negatively charged emitted β -particles are
 - (a) the electrons produced as a result of the decay of neutrons inside the nucleus
 - (b) the electrons produced as a result of collisions between atoms
 - (c) the electrons orbiting around the nucleus
 - (d) the electrons present inside the nucleus.
9. The phase difference between the instantaneous velocity and acceleration of a particle executing simple harmonic motion is
 - (a) π
 - (b) 0.707π
 - (c) zero
 - (d) 0.5π
10. In a mass spectrometer used for measuring the masses of ions, the ions are initially accelerated by an electric potential V and then made to describe semicircular path of radius R using a magnetic field B . If V and B are kept constant, the ratio $\left(\frac{\text{charge on the ion}}{\text{mass of the ion}} \right)$ will be proportional to
 - (a) $1/R^2$
 - (b) R^2
 - (c) R
 - (d) $1/R$
11. A wheel has angular acceleration of 3.0 rad/sec^2 and an initial angular speed of 2.00 rad/sec . In a time of 2 sec it has rotated through an angle (in radian) of
 - (a) 10
 - (b) 12
 - (c) 4
 - (d) 6

12. A hollow cylinder has a charge q coulomb within it. If ϕ is the electric flux in units of voltmeter associated with the curved surface B, the flux linked with the plane surface A in units of voltmeter will be

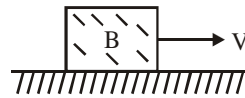


- (a) $\frac{q}{2\epsilon_0}$ (b) $\frac{\phi}{3}$
- (c) $\frac{q}{\epsilon_0} - \phi$ (d) $\frac{1}{2}\left(\frac{q}{\epsilon_0} - \phi\right)$
13. The frequency of a light wave in a material is 2×10^{14} Hz and wavelength is 5000 Å. The refractive index of material will be
(a) 1.50 (b) 3.00 (c) 1.33 (d) 1.40
14. A nucleus A_ZX has mass represented by $M(A, Z)$. If M_p and M_n denote the mass of proton and neutron respectively and B.E. the binding energy in MeV, then
(a) B.E. = $[ZM_p + (A - Z)M_p - M(A, Z)]c^2$
(b) B.E. = $[ZM_p + ZM_n - M(A, Z)]c^2$
(c) B.E. = $M(A, Z) - ZM_p - (A - Z)M_n$
(d) B.E. = $[M(A, Z) - ZM_p - (A - Z)M_n]c^2$
15. The total power dissipated in watts in the circuit shown here is



- (a) 40 (b) 54 (c) 4 (d) 16
16. If the nucleus ${}^{27}_{13}\text{Al}$ has nuclear radius of about 3.6 fm, then ${}^{125}_{32}\text{Te}$ would have its radius approximately as
(a) 9.6 fm (b) 12.0 fm
(c) 4.8 fm (d) 6.0 fm.

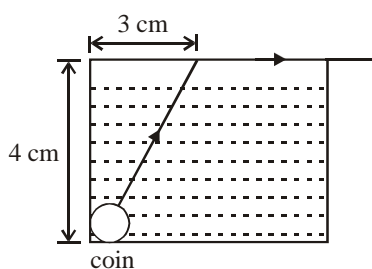
17. A block B is pushed momentarily along a horizontal surface with an initial velocity V . If μ is the coefficient of sliding friction between B and the surface, block B will come to rest after a time



- (a) $g\mu/V$ (b) g/V
(c) V/g (d) $V/(g\mu)$.
18. A particle moving along x-axis has acceleration f , at time t , given by $f = f_0\left(1 - \frac{t}{T}\right)$, where f_0 and T are constants. The particle at $t = 0$ has zero velocity. In the time interval between $t = 0$ and the instant when $f = 0$, the particle's velocity (v_x) is

- (a) $\frac{1}{2}f_0T^2$ (b) f_0T^2
(c) $\frac{1}{2}f_0T$ (d) f_0T .
19. A common emitter amplifier has a voltage gain of 50, an input impedance of 100Ω and an output impedance of 200Ω . The power gain of the amplifier is
(a) 1000 (b) 1250 (c) 100 (d) 500.
20. Three resistances P, Q, R each of 2Ω and an unknown resistance S form the four arms of a Wheatstone bridge circuit. When a resistance of 6Ω is connected in parallel to S the bridge gets balanced. What is the value of S?
(a) 3Ω (b) 6Ω
(c) 1Ω (d) 2Ω
21. A steady current of 1.5 amp flows through a copper voltameter for 10 minutes. If the electrochemical equivalent of copper is 30×10^{-5} g coulomb $^{-1}$, the mass of copper deposited on the electrode will be
(a) 0.50 g (b) 0.67 g (c) 0.27 g (d) 0.40 g.

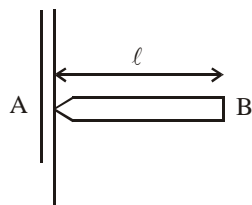
22. A small coin is resting on the bottom of a beaker filled with liquid. A ray of light from the coin travels upto the surface of the liquid and moves along its surface. How fast is the light travelling in the liquid?



- (a) 2.4×10^8 m/s (b) 3.0×10^8 m/s
 (c) 1.2×10^8 m/s (d) 1.8×10^8 m/s
23. A transformer is used to light a 100 W and 110 V lamp from a 220 V mains. If the main current is 0.5 amp, the efficiency of the transformer is approximately
- (a) 50% (b) 90% (c) 10% (d) 30%.
24. Dimensions of resistance in an electrical circuit, in terms of dimension of mass M, of length L, of time T and of current I, would be
- (a) ML^2T^{-2} (b) $ML^2T^{-1}I^{-1}$
 (c) $ML^2T^{-3}I^{-2}$ (d) $ML^2T^{-3}I^{-1}$
25. A uniform rod AB of length ℓ , and mass m is free to rotate about point A. The rod is released from rest in the horizontal position. Given that the

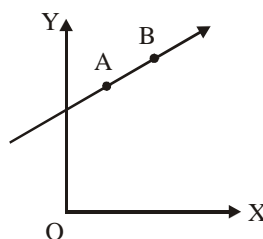
moment of inertia of the rod about A is $\frac{m\ell^2}{3}$,

the initial angular acceleration of the rod will be

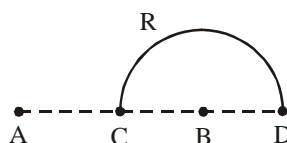


- (a) $\frac{mg\ell}{2}$ (b) $\frac{3}{2}g\ell$
 (c) $\frac{3g}{2\ell}$ (d) $\frac{2g}{3\ell}$


26. A particle of mass m moves in the XY plane with a velocity v along the straight line AB. If the angular momentum of the particle with respect to origin O is L_A when it is at A and L_B when it is at B, then



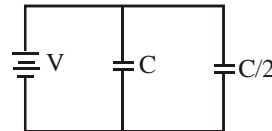
- (a) $L_A = L_B$
 (b) the relationship between L_A and L_B depends upon the slope of the line AB
 (c) $L_A < L_B$
 (d) $L_A > L_B$
27. The particle executing simple harmonic motion has a kinetic energy $K_0 \cos^2 \omega t$. The maximum values of the potential energy and the total energy are respectively
- (a) $K_0/2$ and K_0 (b) K_0 and $2K_0$
 (c) K_0 and K_0 (d) 0 and $2K_0$
28. Charges +q and -q are placed at points A and B respectively which are a distance 2L apart, C is the midpoint between A and B. The work done in moving a charge +Q along the semicircle CRD is



- (a) $\frac{qQ}{2\pi\epsilon_0 L}$ (b) $\frac{qQ}{6\pi\epsilon_0 L}$
 (c) $-\frac{qQ}{6\pi\epsilon_0 L}$ (d) $\frac{qQ}{4\pi\epsilon_0 L}$
29. Monochromatic light of frequency 6.0×10^{14} Hz is produced by a laser. The power emitted is 2×10^{-3} W. The number of photons emitted, on the average, by the sources per second is
- (a) 5×10^{16} (b) 5×10^{17}
 (c) 5×10^{14} (d) 5×10^{15}

30. Three point charges $+q$, $-q$ and $+q$ are placed at points $(x=0, y=a, z=0)$, $(x=0, y=0, z=0)$ and $(x=a, y=0, z=0)$ respectively. The magnitude and direction of the electric dipole moment vector of this charge assembly are
- $\sqrt{2}qa$ along the line joining points $(x=0, y=0, z=0)$ and $(x=a, y=a, z=0)$
 - qa along the line joining points $(x=0, y=0, z=0)$ and $(x=a, y=a, z=0)$
 - $\sqrt{2}qa$ along +ve x direction
 - $\sqrt{2}qa$ along +ve y direction
31. Two satellites of earth, S_1 and S_2 are moving in the same orbit. The mass of S_1 is four times the mass of S_2 . Which one of the following statements is true?
- The potential energies of earth satellites in the two cases are equal.
 - S_1 and S_2 are moving with the same speed.
 - The kinetic energies of the two satellites are equal.
 - The time period of S_1 is four times that of S_2 .
32. \vec{A} and \vec{B} are two vectors and θ is the angle between them, if $|\vec{A} \times \vec{B}| = \sqrt{3}(\vec{A} \cdot \vec{B})$, the value of θ is
- 45°
 - 30°
 - 90°
 - 60°
33. A mass of 2.0 kg is put on a flat pan attached to a vertical spring fixed on the ground as shown in the figure. The mass of the spring and the pan is negligible. When pressed slightly and released the mass executes a simple harmonic motion. The spring constant is 200 N/m. What should be the minimum amplitude of the motion so that the mass gets detached from the pan (take $g = 10 \text{ m/s}^2$)?
- 
- 10.0 cm
 - any value less than 12.0 cm
 - 4.0 cm
 - 8.0 cm
34. A charged particle (charge q) is moving in a circle of radius R with uniform speed v . The associated magnetic moment μ is given by
- qvR^2
 - $qvR^2/2$
 - qvR
 - $qvR/2$

35. The total energy of electron in the ground state of hydrogen atom is -13.6 eV . The kinetic energy of an electron in the first excited state is
- 6.8 eV
 - 13.6 eV
 - 1.7 eV
 - 3.4 eV.
36. A 5 watt source emits monochromatic light of wavelength 5000 \AA . When placed 0.5 m away, it liberates photoelectrons from a photosensitive metallic surface. When the source is moved to a distance of 1.0 m, the number of photoelectrons liberated will be reduced by a factor of
- 8
 - 16
 - 2
 - 4
37. A particle executes simple harmonic oscillation with an amplitude a . The period of oscillation is T . The minimum time taken by the particle to travel half of the amplitude from the equilibrium position is
- $T/8$
 - $T/12$
 - $T/2$
 - $T/4$
38. For a cubic crystal structure which one of the following relations indicating the cell characteristics is correct?
- $a \neq b \neq c$ and $\alpha = \beta = \gamma = 90^\circ$
 - $a = b = c$ and $\alpha \neq \beta \neq \gamma = 90^\circ$
 - $a = b = c$ and $\alpha = \beta = \gamma = 90^\circ$
 - $a \neq b \neq c$ and $\alpha \neq \beta$ and $\gamma \neq 90^\circ$
39. Two condensers, one of capacity C and other of capacity $C/2$ are connected to a V -volt battery, as shown.



- The work done in charging fully both the condensers is
- $\frac{1}{4}CV^2$
 - $\frac{3}{4}CV^2$
 - $\frac{1}{2}CV^2$
 - $2CV^2$.
40. A black body is at 727° C . It emits energy at a rate which is proportional to
- $(1000)^4$
 - $(1000)^2$
 - 727^4
 - $(727)^2$
41. The resistance of an ammeter is 13Ω and its scale is graduated for a current upto 100 amps. After an additional shunt has been connected to this ammeter it becomes possible to measure currents upto 750 amperes by this meter. The value of shunt-resistance is
- 2Ω
 - 0.2Ω
 - $2 \text{ k}\Omega$
 - 20Ω

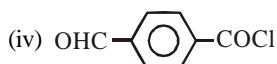
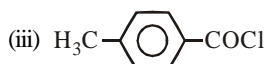
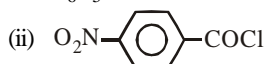
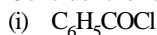
42. An engine has an efficiency of $1/6$. When the temperature of sink is reduced by 62°C , its efficiency is doubled. Temperature of the source is
 (a) 37°C (b) 62°C (c) 99°C (d) 124°C
43. The electric and magnetic field of an electromagnetic wave are
 (a) in opposite phase and perpendicular to each other
 (b) in opposite phase and parallel to each other
 (c) in phase and perpendicular to each other
 (d) in phase and parallel to each other.
44. What is the value of inductance L for which the current is maximum in a series LCR circuit with $C = 10\ \mu\text{F}$ and $\omega = 1000\text{s}^{-1}$
 (a) 1mH
 (b) cannot be calculated unless R is known
 (c) 10mH
 (d) 100mH
45. Nickel shows ferromagnetic property at room temperature. If the temperature is increased beyond Curie temperature, then it will show
 (a) anti ferromagnetism
 (b) no magnetic property
 (c) diamagnetism
 (d) paramagnetism
46. A vertical spring with force constant k is fixed on a table. A ball of mass m at a height h above the free upper end of the spring falls vertically on the spring so that the spring is compressed by a distance d . The net work done in the process is
 (a) $mg(h+d) - \frac{1}{2}kd^2$
 (b) $mg(h-d) - \frac{1}{2}kd^2$
 (c) $mg(h-d) + \frac{1}{2}kd^2$
 (d) $mg(h+d) + \frac{1}{2}kd^2$
47. Under the influence of a uniform magnetic field a charged particle is moving in a circle of radius R with constant speed v . The time period of the motion
 (a) depends on both R and v
 (b) is independent of both R and v
 (c) depends on R and not on v
 (d) depends on v and not on R
48. If the cold junction of a thermo-couple is kept at 0°C and the hot junction is kept at $T^\circ\text{C}$ then the relation between neutral temperature (T_n) and temperature of inversion (T_i) is
 (a) $T_n = 2T_i$ (b) $T_n = T_i - T$
 (c) $T_n = T_i + T$ (d) $T_n = T_i/2$
49. Assuming the sun to have a spherical outer surface of radius r , radiating like a black body at temperature $t^\circ\text{C}$, the power received by a unit surface, (normal to the incident rays) at a distance R from the centre of the sun is
 (a) $\frac{r^2\sigma(t+273)^4}{4\pi R^2}$ (b) $\frac{16\pi^2 r^2\sigma t^4}{R^2}$
 (c) $\frac{r^2\sigma(t+273)^4}{R^2}$ (d) $\frac{4\pi r^2\sigma t^4}{R^2}$
 where σ is the Stefan's constant.
50. In the energy band diagram of a material shown below, the open circles and filled circles denote holes and electrons respectively. The material is

 (a) an insulator
 (b) a metal
 (c) an n-type semiconductor
 (d) a p-type semiconductor

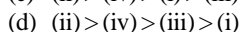
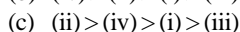
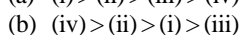
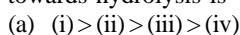
CHEMISTRY

51. Which one of the following on reduction with lithium aluminium hydride yields a secondary amine?
 (a) Methyl isocyanide
 (b) Acetamide
 (c) Methyl cyanide
 (d) Nitroethane.

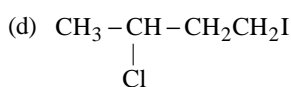
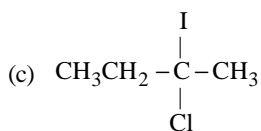
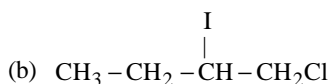
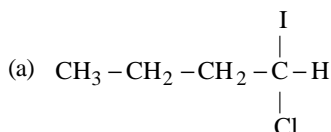
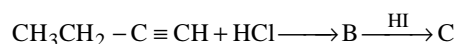
63. Consider the following compounds.



The correct decreasing order of their reactivity towards hydrolysis is



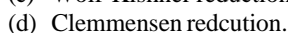
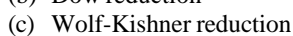
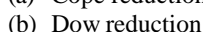
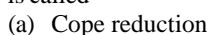
64. Predict the product C obtained in the following reaction of butyne-1.



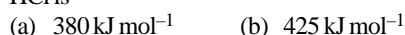
65. Concentrated aqueous sulphuric acid is 98% H_2SO_4 by mass and has a density of 1.80 g mL^{-1} . Volume of acid required to make one litre of $0.1M H_2SO_4$ solution is



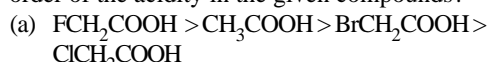
66. Reduction of aldehydes and ketones into hydrocarbons using zinc amalgam and conc. HCl is called



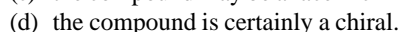
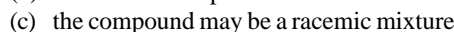
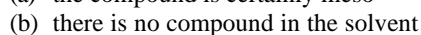
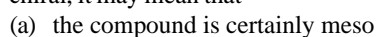
67. Given that bond energies of H-H and Cl-Cl are 430 kJ mol^{-1} and 240 kJ mol^{-1} respectively and ΔH_f for HCl is -90 kJ mol^{-1} , bond enthalpy of HCl is



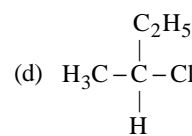
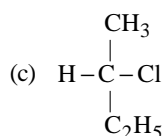
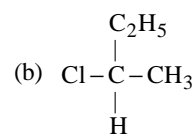
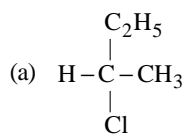
68. Which of the following represents the correct order of the acidity in the given compounds?



69. If there is no rotation of plane polarised light by a compound in a specific solvent, though to be chiral, it may mean that



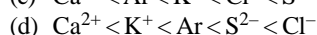
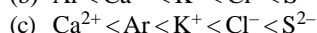
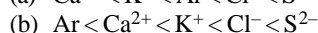
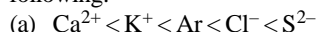
70. $CH_3 - CHCl - CH_2 - CH_3$ has a chiral centre. which one of the following represents its R-configuration?



71. Which of the following is water-soluble?



72. Identify the correct order of the size of the following:



73. 0.5 molal aqueous solution of a weak acid (HX) is 20% ionised. If K_f for water is $1.86 \text{ K kg mol}^{-1}$, the lowering in freezing point of the solution is



74. Sulphide ores of metals are usually concentrated by froth flotation process. Which one of the following sulphide ores offer an exception and its concentrated by chemical leaching?
 (a) Galena (b) Copper pyrite
 (c) Sphalerite (d) Argentite
75. If 60% of a first order reaction was completed in 60 minutes, 50% of the same reaction would be completed in approximately
 (a) 45 minutes (b) 60 minutes
 (c) 40 minutes (d) 50 minutes
 ($\log 4 = 0.60, \log 5 = 0.69$)
76. Which of the following will give a pair of enantiomorphs?
 (a) $[\text{Cr}(\text{NH}_3)_6][\text{Co}(\text{CN})_6]$
 (b) $[\text{Co}(\text{en})_2\text{Cl}_2]\text{Cl}$
 (c) $[\text{Pt}(\text{NH}_3)_4][\text{PtCl}_6]$
 (d) $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]\text{NO}_2$. (en = $\text{NH}_2\text{CH}_2\text{CH}_2\text{NH}_2$)
77. If NaCl is doped with 10^{-4} mol % of SrCl_2 , the concentration of cation vacancies will be ($N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$)
 (a) $6.02 \times 10^{16} \text{ mol}^{-1}$ (b) $6.02 \times 10^{17} \text{ mol}^{-1}$
 (c) $6.02 \times 10^{14} \text{ mol}^{-1}$ (d) $6.02 \times 10^{15} \text{ mol}^{-1}$
78. The d electron configurations of Cr^{2+} , Mn^{2+} , Fe^{2+} and Ni^{2+} are $3d^4$, $3d^5$, $3d^6$ and $3d^8$ respectively. Which one of the following aqua complexes will exhibit the minimum paramagnetic behaviour?
 (a) $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ (b) $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$
 (c) $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ (d) $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$
 (At. No. Cr = 24, Mn = 25, Fe = 26, Ni = 28)
79. In which of the following the hydration energy is higher than the lattice energy?
 (a) MgSO_4 (b) RaSO_4
 (c) SrSO_4 (d) BaSO_4
80. Which of the compounds with molecular formula C_5H_{10} yields acetone on ozonolysis?
 (a) 3-methyl-1-butene
 (b) cyclopentane
 (c) 2-methyl-1-butene
 (d) 2-methyl-2-butene.
81. With which of the following electronic configuration an atom has the lowest ionisation enthalpy?
 (a) $1s^2 2s^2 sp^3$ (b) $1s^2 2s^2 2p^5 3s^1$
 (c) $1s^2 2s^2 2p^6$ (d) $1s^2 2s^2 2p^5$
82. Which one of the following ionic species has the greatest proton affinity to form stable compound?
 (a) NH_2^- (b) F^- (c) I^- (d) HS^-
83. The following equilibrium constants are given:

$$\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3; K_1$$

$$\text{N}_2 + \text{O}_2 \rightleftharpoons 2\text{NO}; K_2$$

$$\text{H}_2 + \frac{1}{2}\text{O}_2 \rightleftharpoons \text{H}_2\text{O}; K_3$$
 The equilibrium constant for the oxidation of NH_3 by oxygen to give NO is
 (a) $\frac{K_2 K_3^2}{K_1}$ (b) $\frac{K_2^2 K_3}{K_1}$
 (c) $\frac{K_1 K_2}{K_3}$ (d) $\frac{K_2 K_3^3}{K_1}$
84. Which one of the following ions is the most stable in aqueous solution?
 (a) V^{3+} (b) Ti^{3+}
 (c) Mn^{3+} (d) Cr^{3+}
 (At.No. Ti = 22, V = 23, Cr = 24, Mn = 25)
85. The correct order of C–O bond length among CO, CO_3^{2-} , CO_2 is
 (a) $\text{CO} < \text{CO}_3^{2-} < \text{CO}_2$
 (b) $\text{CO}_3^{2-} < \text{CO}_2 < \text{CO}$
 (c) $\text{CO} < \text{CO}_2 < \text{CO}_3^{2-}$
 (d) $\text{CO}_2 < \text{CO}_3^{2-} < \text{CO}$
86. Which one of the following orders correctly represents the increasing acid strengths of the given acids?
 (a) $\text{HOClO} < \text{HOCl} < \text{HOClO}_3 < \text{HOClO}_2$
 (b) $\text{HOClO}_2 < \text{HOClO}_3 < \text{HOClO} < \text{HOCl}$
 (c) $\text{HOClO}_3 < \text{HOClO}_2 < \text{HOClO} < \text{HOCl}$
 (d) $\text{HOCl} < \text{HOClO} < \text{HOClO}_2 < \text{HOClO}_3$
87. Which one of the following on treatment with 50% aqueous sodium hydroxide yields the corresponding alcohol and acid?
 (a) $\text{C}_6\text{H}_5\text{CHO}$ (b) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}$
 (c) $\text{CH}_3 - \overset{\text{O}}{\parallel} \text{C} - \text{CH}_3$ (d) $\text{C}_6\text{H}_5\text{CH}_2\text{CHO}$
88. For (i) I^- , (ii) Cl^- , (iii) Br^- , the increasing order of nucleophilicity would be
 (a) $\text{Cl}^- < \text{Br}^- < \text{I}^-$ (b) $\text{I}^- < \text{Cl}^- < \text{Br}^-$
 (c) $\text{Br}^- < \text{Cl}^- < \text{I}^-$ (d) $\text{I}^- < \text{Br}^- < \text{Cl}^-$
89. Calculate the pOH of a solution at 25°C that contains $1 \times 10^{-10} \text{ M}$ of hydronium ions, i.e. H_3O^+ .
 (a) 4.000 (b) 9.0000 (c) 1.000 (d) 7.000

90. Consider the following sets of quantum numbers:
- | | n | l | m | s |
|-------|---|---|----|------|
| (i) | 3 | 0 | 0 | +1/2 |
| (ii) | 2 | 2 | 1 | +1/2 |
| (iii) | 4 | 3 | -2 | -1/2 |
| (iv) | 1 | 0 | -1 | -1/2 |
| (v) | 3 | 2 | 3 | +1/2 |
- Which of the following sets of quantum number is not possible?
- (a) (i), (ii), (iii) and (iv) (b) (ii), (iv) and (v)
 (c) (i) and (iii) (d) (ii), (iii) and (iv)
91. The equilibrium constant of the reaction:
- $$\text{Cu}_{(s)} + 2\text{Ag}^+_{(aq)} \longrightarrow \text{Cu}^{2+}_{(aq)} + 2\text{Ag}_{(s)};$$
- $E^\circ = 0.46 \text{ V}$ at 298 K is
- (a) 2.0×10^{10} (b) 4.0×10^{10}
 (c) 4.0×10^{15} (d) 2.4×10^{10}
92. Which one of the following polymers is prepared by condensation polymerisation?
- (a) Teflon (b) Natural rubber
 (c) Styrene (d) Nylon-66
93. The order of decreasing reactivity towards an electrophilic reagent, for the following would be
- (i) benzene (ii) toluene
 (iii) chlorobenzene (iv) phenol
- (a) (ii) > (iv) > (i) > (iii)
 (b) (iv) > (iii) > (ii) > (i)
 (c) (iv) > (ii) > (i) > (iii)
 (d) (i) > (ii) > (iii) > (iv)
94. Which of the following anions is present in the chain structure of silicates?
- (a) $(\text{Si}_2\text{O}_5^{2-})_n$ (b) $(\text{SiO}_3^{2-})_n$
 (c) SiO_4^{4-} (d) $\text{Si}_2\text{O}_7^{6-}$
95. An element, X has the following isotopic composition:
 $^{200}\text{X} : 90\%$ $^{199}\text{X} : 8.0\%$ $^{202}\text{X} : 2.0\%$
 The weighted average atomic mass of the naturally occurring element X is closest to
- (a) 201 amu (b) 202 amu
 (c) 199 amu (d) 200 amu
96. The fraction of total volume occupied by the atoms present in a simple cube is
- (a) $\frac{\pi}{3\sqrt{2}}$ (b) $\frac{\pi}{4\sqrt{2}}$
 (c) $\frac{\pi}{4}$ (d) $\frac{\pi}{6}$
97. In the reaction:
- $$\text{CH}_3 - \overset{\text{CH}_3}{\underset{|}{\text{CH}}} - \text{CH}_2 - \text{O} - \text{CH}_2 - \text{CH}_3 + \text{HI} \xrightarrow{\text{Heated}}$$
- Which of the following compounds will be formed?
- (a) $\text{CH}_3 - \overset{\text{CH}_3}{\underset{|}{\text{CH}}} - \text{CH}_3 + \text{CH}_3\text{CH}_2\text{OH}$
 (b) $\text{CH}_3 - \overset{\text{CH}_3}{\underset{|}{\text{CH}}} - \text{CH}_2\text{OH} + \text{CH}_3\text{CH}_3$
 (c) $\text{CH}_3 - \overset{\text{CH}_3}{\underset{|}{\text{CH}}} - \text{CH}_2\text{OH} + \text{CH}_3 - \text{CH}_2 - \text{I}$
 (d) $\text{CH}_3 - \overset{\text{CH}_3}{\underset{|}{\text{CH}}} - \text{CH}_2 - \text{I} + \text{CH}_3\text{CH}_2\text{OH}$
98. The product formed in Aldol condensation is
- (a) a beta-hydroxy aldehyde or a beta-hydroxy ketone
 (b) an alpha-hydroxy aldehyde or ketone
 (c) an alpha, beta unsaturated ester
 (d) a beta-hydroxy acid
99. The number of moles of KMnO_4 that will be needed to react with one mole of sulphite ion in acidic solution is
- (a) 4/5 (b) 2/5 (c) 1 (d) 3/5
100. Identify the incorrect statement among the following:
- (a) Lanthanoid contraction is the accumulation of successive shrinkages.
 (b) As a result of lanthanoid contraction, the properties of 4d series of the transition elements have no similarities with the 5d series of elements.
 (c) Shielding power of 4f electrons is quite weak.
 (d) There is a decrease in the radii of the atoms or ions as one proceeds from La to Lu.

BIOLOGY

101. ICBN stands for
 (a) International Code of Botanical Nomenclature
 (b) International congress of Biological Names
 (c) Indian Code of Botanical Nomenclature
 (d) Indian Congress of Biological Names.
102. Which pair of the following belongs to Basidiomycetes
 (a) puffballs and Claviceps
 (b) peziza and stink borns
 (c) Morchella and mushrooms
 (d) birds nest fungi and puffballs.
103. Biological organisation starts with
 (a) cellular level (b) organismic level
 (c) atomic level
 (d) submicroscopic molecular level
104. Identify the odd combination of the habitat and the particular animal concerned.
 (a) sunderbans - Bengal Tiger
 (b) periyar - Elephant
 (c) Rann of kutch - wild Ass
 (d) Dachigam National park - Snow Leopard.
105. If you suspect major deficiency of antibodies in a person to which of the following would you look for confirmatory evidence?
 (a) serum globulins
 (b) fibrinogen in the plasma
 (c) haemocytes (d) serum albumins
106. A common test to find the genotype of a hybrid is by
 (a) crossing of one F_2 progeny with female parent
 (b) studying the sexual behaviour of F_1 progenies
 (c) crossing of one F_1 progeny with male parent
 (d) crossing of one F_2 progeny with male parent.
107. The okazaki fragments in DNA chain growth
 (a) polymerize in the 3' - to - 5' direction and forms replication fork
 (b) prove semi-conservative nature of DNA replication
 (c) polymerize in the 5' - to - 3' direction and explain 3' - to - 5' DNA replication
 (d) result in transcription.
108. Which one of the following statement is correct?
 (a) there is no evidence of the existence of gills during embryogenesis of mammals
 (b) all plant and animal cells are totipotent
 (c) ontogeny repeats phylogeny
 (d) stem cells are specialize cells.
109. In which one of the following the BOD (Biochemical Oxygen Demand) of sewage (s), distillery effluent (DE), paper mill effluent (PE) and sugar mill effluent (SE) have been arranged in ascending order ?
 (a) $SE < PE < S < DE$ (b) $PE < S < SE < DE$
 (c) $S < DE < PE < SE$ (d) $SE < S < PE < DE$.
110. The concept of chemical evolution is based on
 (a) interaction of water, air and clay under intense heat
 (b) effect of solar radiation on chemicals
 (c) possible orgin of life by combination of chemicals under suitable environmental conditions
 (d) crystallization of chemicals.
111. Which one of the following is surrounded by a callose wall?
 (a) male gamete (b) egg
 (c) pollen grain
 (d) microspore mother cell
112. Probiotics are
 (a) cancer inducing microbes
 (b) new kind of food allergens
 (c) live microbial food supplement
 (d) safe antibiotics
113. One of endangered species of Indian medicinal plants is that of
 (a) ocimum (b) garlic
 (c) nepenthes (d) podophyllum
114. What is true about Nereis, scorpion, cockroach and silver fish ?
 (a) they all posses dorsal heart
 (b) none of them is aquatic
 (c) they all belong to the same phylum
 (d) they all have jointed paired appendages
115. The living organisms can be unexceptionally distinguished from the non-living things on the basis of their ability for
 (a) interaction with the environment and progressive evolution
 (b) reproduction
 (c) growth and movement
 (d) responsiveness to touch.

116. A person who is on a long hunger strike and is surviving only on water, will have.
- less amino acids in his urine
 - more glucose in his blood
 - less urea in his urine
 - more sodium in his urine .
117. The length of DNA molecule greatly exceeds the dimensions of the nucleus in eukaryotic cells. How is this DNA accommodated?
- super-coiling in nucleosomes
 - DNase digestion
 - through elimination of repetitive DNA
 - deletion of non-essential genes.
118. A sequential expression of a set of human genes
- messenger RNA
 - DNA sequence
 - ribosome
 - transfer RNA.
119. In a coal fired power plant electrostatic precipitators are installed to control emission of
- NO_x
 - SPM
 - CO
 - SO₂
120. Select the wrong statement from the following.
- Both chloroplasts and mitochondria have an internal compartment, the thylakoid space bounded by the thylakoid membrane
 - Both chloroplasts and mitochondria contain DNA
 - The chloroplasts are generally much larger than mitochondria
 - Both chloroplasts and mitochondria contain an inner and an outer membrane.
121. Geometric representation of age structure is a characteristic of
- population
 - landscape
 - ecosystem
 - biotic community.
122. During transcription, RNA polymerase holoenzyme binds to a gene promoter and assumes a saddle-like structure, what is its DNA-binding sequence?
- AATT
 - CACC
 - TATA
 - TTAA
123. A plant requires magnesium for
- protein synthesis
 - chlorophyll synthesis
 - cell wall development
 - holding cells together.
124. In the prothallus of a vascular cryptogam, the antherozoids and eggs mature at different times. As a result
- there is a high degree of sterility
 - one can conclude that the plant is apomictic
 - self-fertilization is prevented
 - there is no change in success rate of fertilization
125. Ergot of rye is caused by a species of
- uncinula
 - ustilago
 - claviceps
 - phytophthora.
126. The finches of Galapagos islands provide an evidence in favour of
- evolution due to mutation
 - retrogressive evolution
 - biogeographical evolution
 - special creation .
127. Which one of the following is a slime mould?
- physarum
 - Thiobacillus
 - Anabaena
 - Rhizopus.
128. The population of an insect species shows an explosive increase in numbers during rainy season followed by its disappearance at the end of the season. What does this show?
- the food plants mature and die at the end of the rainy season
 - its population growth curve is of J-type
 - the population of its predators increases enormously
 - S-shaped or sigmoid growth of this insect.
129. Which of the following is a flowering plant with nodules containing filamentous nitrogen-fixing micro-organism
- crotalaria juncea
 - cycas revoluta
 - cicer arietinum
 - casuarina equisetifolia
130. Which one of the following is being utilized as a source of biodiesel in the Indian countryside?
- betroot
 - sugarcane
 - pongamia
 - euphorbia
131. For a critical study of secondary growth in plants, which one of the following pairs is suitable?
- teak and pine
 - deodar and fern
 - wheat and maiden hair fern
 - sugarcane and sunflower.
132. Which one of the following is a fat-soluble vitamin and its related deficiency disease?
- Retinol - Xerophthalmia
 - Cobalamine - Beri-beri
 - Calciferol - Pellagra
 - A scorbic acid - Scurvy.

133. Two cells A and B are contiguous. Cell A has osmotic pressure 10 atm, turgor pressure 7 atm and diffusion pressure deficit 3 atm. Cell B has osmotic pressure 8 atm, turgor pressure 3 atm and diffusion pressure deficit 5 atm. The result will.
- no movement of water
 - equilibrium between the two
 - movement of water from cell A to B.
 - movement of water from cell B to A.
134. In which one of the following preparations are your likely to come across cell junctions most frequently ?
- thrombocytes
 - tendon
 - hyaline cartilage
 - ciliated epithelium.
135. If you are asked to classify the various algae into distinct groups, which of the following characters you should choose?
- nature of stored food materials in the cell
 - structural organization of thallus
 - chemical composition of the cell wall
 - types of pigments present in the cell.
136. About 98 percent of the mass of every living organism is composed of just six elements including carbon, hydrogen, nitrogen, oxygen and
- sulphur and magnesium
 - magnesium and sodium
 - calcium and phosphorus
 - phosphorus and sulphur.
137. Which one of the following statements is correct?
- Both Azotobacter and Rhizobium fix atmospheric nitrogen in root nodules of plants.
 - Cyanobacteria such as Anabaena and Nostoc are important mobilizers of phosphates and for plant nutrition in soil
 - At present it is not possible to grow maize without chemical fertilizers
 - Extensive use of chemical fertilizers may lead to eutrophication of nearby water bodies.
138. In the hexaploid wheat, the haploid (n) and basic (x) numbers of chromosomes are
- $n = 21$ and $x = 21$
 - $n = 21$ and $x = 14$
 - $n = 21$ and $x = 7$
 - $n = 7$ and $x = 21$.
39. Passage cells are thin walled cells found in
- phloem elements that serve as entry points for substance for transport of other plant parts
 - testa of seeds to enable emergence of growing embryonic axis during seed germination
 - central region of style through which the pollen tube grows towards the ovary
 - endodermis of roots facilitating rapid transport of water from cortex to pericycle.
140. What is common between parrot, platypus and kangaroo?
- toothless jaws
 - functional post-end tail
 - ovoparity
 - homiothermy
141. Bowman's glands are located in the
- anterior pituitary
 - female reproductive system of cockroach
 - olfactory epithelium of our nose
 - proximal end of uriniferous tubules.
142. Which one of the following pairs is wrongly matched ?
- yeast - ethanol
 - streptomycetes - antibiotic
 - coliforms - vinegar
 - methanogens - gobar gas.
143. Which part of ovary in mammals acts as an endocrine gland after ovulation ?
- stroma
 - germinal epithelium
 - vitelline membrane
 - Graafian follicle.
144. Opening of floral buds into flowers, is a type of
- autonomic movement of variation
 - paratonic movement of growth
 - autonomic movement of growth
 - autonomic movement of locomotion.
145. Which one of the following is a matching pair of a body feature and the animal possessing it ?
- ventral central nervous system - Leech
 - Pharyngeal gill slits absent in embryo - Chamaeleon
 - ventral heart - Scorpion
 - post-end tail - Octopus.
146. All enzymes of TCA cycle are located in the mitochondrial matrix except one which is located in inner mitochondrial membranes in eukaryotes and in cytosol in prokaryotes. This enzyme is
- isocitrate dehydrogenase
 - malate dehydrogenase
 - succinate dehydrogenase
 - lactate dehydrogenase.

147. The first acceptor of electrons from an excited chlorophyll molecule of photosystem II is
(a) iron-sulphur protein
(b) ferredoxin
(c) quinone (d) cytochrome
148. Differentiation of organs and tissues in a developing organism, is associated with
(a) differential expression of genes
(b) lethal mutations (c) deletion of genes
(d) developmental mutations.
149. Which one of the following statements about mycoplasma is wrong ?
(a) They are pleomorphic
(b) They are sensitive to penicillin
(c) They cause diseases in plants
(d) They are also called PPLO.
150. Which one of the following pairs is mismatched?
(a) Apis indica - honey
(b) kenia lacca - lac
(c) Bombyx mori - silk
(d) Pila globosa - pearl
151. A person is having problems with calcium and phosphorus metabolism in his body. Which one of following glands may not be functioning properly ?
(a) parotid (b) pancreas
(c) thyroid (d) parathyroid
152. A genetically engineered micro-organism use successfully in bioremediation of oil spills is a species of
(a) Trichoderma (b) Xanthomonas
(c) Bacillus (d) Pseudomonas.
153. In the leaves of C_4 plants, malic acid formation during CO_2 fixation occurs in the cells of
(a) bundle sheath (b) phloem
(c) epidermis (d) mesophyll
154. Flagellated male gametes are present in all the three of which one of the following sets ?
(a) Zygnema, Saprolegnia and Hydrilla
(b) fucus, Marsilea and Calotropis
(c) Riccia, Dryopteris and Cycas
(d) Anthoceros, Funaria and Spirogyra
155. In the mean and the median pertaining to a certain character of a population are of the same value, which of the following is most likely to occur
(a) a bi-modal distribution
(b) a T-shaped curve
(c) a skewed curve
(d) a normal distribution.
156. One gene-one enzyme relationship was established for the first time in
(a) Salmonella typhimurium
(b) Escherichia coli
(c) Diplococcus pneumoniae
(d) Neurospora crassa.
157. Two genes R and Y are located very close on the chromosomal linkage map of maize plant. When RRY Y and rryy genotypes are hybridized, the F_2 segregation will show
(a) segregation in the expected 9 : 3 : 3 : 1 ratio
(b) segregation in 3 : 1 ratio
(c) higher number of the parental types
(d) higher number of the recombinant types.
158. In cloning of cattle, a fertilized egg is taken out of the mother's womb and
(a) in the eight cell stage, cells are separated and cultured until small embryos are formed which are implanted into the womb of other cow
(b) in the eight cell stage the individual cells are separated under electrical field for further development in culture media.
(c) from this upto eight identical twins can be produced
(d) the egg is divided into 4 pairs of cells which are implanted into the womb of other cows
159. Ultrasound of how much frequency is beamed into human body for sonography ?
(a) 15 - 30 MHZ (b) 1 - 15 MHZ
(c) 45 - 70 MHZ (d) 30 - 45 MHZ.
160. Two plants can be conclusively said to belong to the same species if they.
(a) have more than 90 per cent similar genes
(b) look similar and possess identical secondary metabolites
(c) have same number of chromosomes
(d) can reproduce freely with each other and form seeds.
161. Inheritances of skin colour in humans is an example of
(a) point mutation
(b) polygenic inheritance
(c) codominance
(d) chromosomal aberration.
162. When two species of different genealogy come to resemble each other as a result of adaptation, the phenomenon is termed
(a) microevolution (b) co-evolution
(c) convergent evolution
(d) divergent evolution

163. Increased asthmatics attacks in certain seasons are related to
 (a) eating fruits preserved in tin containers
 (b) inhalation of seasonal pollen
 (c) low temperature
 (d) hot and humid environment.
164. Among the human ancestors the brain size was more than 1000 CC in
 (a) Homo erectus (b) Ramapithecus
 (c) Homo habilis
 (d) Homo neanderthalensis
165. Industrial melanism as observed in peppered moth proves that
 (a) the melanic form of the moth has no selective advantage over lighter form in industrial area
 (b) the lighter-form moth has no selective advantage either in polluted industrial area or non-polluted area
 (c) melanism is a pollution-generated feature
 (d) the true black melanic forms arise by a recurring random mutation.
166. A high density of elephant population in an area can result in
 (a) intra specific competition
 (b) inter specific competition
 (c) predation on one another
 (d) mutualism.
167. A drop of each of the following, is placed separately on four slides. Which of them will not coagulate?
 (a) blood serum
 (b) sample from the thoracic duct of lymphatic system
 (c) Whole blood from pulmonary vein
 (d) blood plasma.
168. Which one of the following ecosystem types has the highest annual net primary productivity?
 (a) tropical deciduous forest
 (b) temperate evergreen forest
 (c) temperate deciduous forest
 (d) tropical rain forest.
169. In human body, which one of the following is anatomically correct?
 (a) Collar bones - 3 pairs
 (b) Salivary glands - 1 pairs
 (c) Cranial nerves - 10 pairs
 (d) Floating ribs - 2 pairs
170. Telomere repetitive DNA sequences control the function of eukaryotic chromosomes because they
 (a) are RNA transcription initiator
 (b) help chromosome pairing
 (c) prevent chromosome loss
 (d) act as replicons.
171. Spore dissemination in some liverworts is aided by
 (a) indusium (b) calyptra
 (c) peristome teeth (d) elaters.
172. Which one of the following elements is not an essential micronutrient for plant growth?
 (a) Zn (b) Cu (c) Ca (d) Mn
173. The overall goal of glycolysis, krebs cycle and the electron transport system is the formation of
 (a) ATP in one large oxidation reaction
 (b) sugars (c) nucleic acids
 (d) ATP in small stepwise units.
174. Adaptive radiation refers to
 (a) evolution of different species from a common ancestor
 (b) migration of members of a species to different geographical areas
 (c) power of adaptation in an individual to a variety of environments
 (d) adaptations due to geographical isolation.
175. Which one of the following pairs, is not correctly matched?
 (a) Gibberellic acid - Leaf fall
 (b) Cytokinin - Cell wall elongation
 (c) IAA - Cell wall elongation
 (d) Abscissic acid - Stomatal closure.
176. Select the correct statement from the following?
 (a) Fitness is the end result of the ability to adapt and gets selected by nature
 (b) All mammals except whales and camels have seven cervical vertebrae
 (c) Mutations are random and directional
 (d) Darwinian variations are small and directionless.
177. Male gametes in angiosperms are formed by the division of
 (a) generative cell (b) vegetative cell
 (c) microspore mother cell
 (d) microspore.
178. In pea plants, yellow seeds are dominant to green. If a heterozygous yellow seeded plant is crossed with a green seeded plant, what ratio of yellow and green seeded plants would you expect in F_1 generation?
 (a) 9:1 (b) 1:3
 (c) 3:1 (d) 50:50

179. Which one of the following mammalian cells is not capable of metabolising glucose to carbon-dioxide aerobically?
 (a) unstrained muscle cells
 (b) liver cells (c) red blood cells
 (d) white blood
180. A human male produces sperms with the genotypes AB, Ab, aB, and ab pertaining to two diallelic characters in equal proportions. What is the corresponding genotype of this person?
 (a) AaBB (b) AABb
 (c) AABB (d) AaBb.
181. What is common to whale, seal and shark?
 (a) thick subcutaneous fat
 (b) convergent evolution
 (c) homiothermy
 (d) seasonal migration.
182. One of the important consequences of geographical isolation is
 (a) preventing speciation
 (b) speciation through reproductive isolation
 (c) random creation of new species
 (d) no change in the isolated fauna.
183. Lysozyme that is present in perspiration, saliva and tears, destroys
 (a) certain types of bacteria
 (b) all viruses
 (c) most virus-infected cells
 (d) certain fungi
184. In the human female, menstruation can be deferred by the administration of
 (a) combination of FSH and LH
 (b) combination of estrogen and progesterone
 (c) FSH only (d) LH only
185. Which one of the following is not a constituent of cell membrane?
 (a) glycolipids (b) proline
 (c) phospholipids (d) cholesterol.
186. Compared to a bull a bullock is docile because of
 (a) higher levels of cortisone
 (b) lower levels of blood testosterone
 (c) lower levels of adrenaline/ noradrenaline in its blood
 (d) higher levels of thyroxine.
187. During the transmission of nerve impulse through a nerve fibre, the potential on the inner side of the plasma membrane has which type of electric change?
 (a) first positive, then negative and continue to be positive
 (b) first negative, then positive and continue to be positive.
 (c) first positive, then negative and again back to positive
 (d) first negative, then positive and again back to negative .
188. Which one of the following pairs of organisms are exotic species introduced in India ?
 (a) lantana camara, water hyacinth
 (b) water hyacinth, prosopis cineraria
 (c) nile perch, licus religiosa
 (d) ficus religiosa , lantana camara.
189. In gymnosperms, the pollen chamber represents
 (a) a cavity in the ovule in which pollen grains are stored after pollination
 (b) an opening in the megagametophyte through which the pollen tube approaches the egg
 (c) the microsporangium in which pollen grains develop
 (d) a cell in the pollen grain in which the sperms are formed.
190. Molecular basis of organ differentiation depends on the modulation in transcription by
 (a) ribosome (b) transcription factor
 (c) anticodon (d) RNA polymerase.
191. Which of the following is an example of negative feedback loop in humans?
 (a) secretion of tears after falling of sand particles into the eye.
 (b) salivation of mouth at the sight of delicious food
 (c) secretion of sweat glands and constriction of skin blood vessels when it is too hot
 (d) constriction of skin blood vessels and contraction of skeletal muscles when it is too cold
192. The two polynucleotide chains in DNA are
 (a) discontinuous (b) antiparallel
 (c) semiconservative (d) parallel.
193. Which of the following pairs are correctly matched ?
 Animals - Morphological features
 (i) Crocodile - 4-chambered heart
 (ii) Sea urchin - Parapodia
 (iii) Obelia - Thecodont
 (iv) Lemur - Thecodont
 (a) (ii), (iii) and (iv) (b) only (i) and (iv)
 (c) only (i) and (ii) (d) (i), (iii) and (iv)

2007-16

CBSE-PMT - 2007 SCREENING SOLVED PAPER

194. Which one of the following pairs of structures distinguishes a nerve cell from other types of cells?
- (a) vacuoles and fibres
 - (b) flagellum and modulloary sheath
 - (c) nucleus and mitochondria
 - (d) perikaryon and dendrites.
195. In maize, hybrid vigour is exploited by
- (a) crossing of two inbred parental lines
 - (b) harvesting seeds from the most productive plants
 - (c) inducing mutations
 - (d) bombarding the seeds with DNA.
196. Which one of the following is a viral disease of poultry ?
- (a) coryza
 - (b) new castle disease
 - (c) pasteurellosis
 - (d) salmonellosis.
197. The wavelength of light absorbed by Pr form of phytochrome is
- (a) 680nm
 - (b) 720nm
 - (c) 620nm
 - (d) 640nm
198. Which one of the following is not a bioindicator of water pollution?
- (a) blood-worms
 - (b) stone flies
 - (c) sewage fungus
 - (d) sludge-worms.
199. Feeling the tremors of an earthquake a scared resident of seventh floor of a multistoryed building starts climbing down the stairs rapidly. Which hormone initiated this action ?
- (a) adrenaline
 - (b) glucagon
 - (c) gastrin
 - (d) thyroxine
200. "Foolish seedling" disease of rice led to the discovery of
- (a) ABA
 - (b) 2,4-D
 - (c) IAA
 - (d) GA

HINTS & SOLUTIONS

1. (a) Since $\frac{V_s}{V_p} = \frac{N_s}{N_p}$
 Where
 N_s = No. of turns across primary coil = 50
 N_p = No. of turns across secondary coil = 1500

$$\text{and } V_p = \frac{d\phi}{dt} = \frac{d}{dt}(\phi_0 + 4t) = 4$$

$$\Rightarrow V_s = \frac{1500}{50} \times 4 = 120 \text{ V}$$

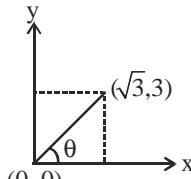
2. (a) If the electric field is switched off, and the same magnetic field is maintained, the electrons move in a circular orbit and electron will travel a magnetic field \perp to its velocity.

3. (a) Speed $v = \frac{dx}{dt} = \frac{d}{dt}(9t^2 - t^3) = 18t - 3t^2$

For maximum speed

$$\frac{dv}{dt} = 0 \Rightarrow 18 - 6t = 0 \Rightarrow t = 3$$

$$\Rightarrow x_{\max} = 81 - 27 = 54$$

4. (b) 

Let θ be the angle which the particle makes with x axis.

$$\text{From figure, } \tan \theta = \frac{3}{\sqrt{3}} = \sqrt{3}$$

$$\Rightarrow \theta = \tan^{-1}(\sqrt{3}) = 60^\circ$$

5. (d) Since average speed

$$= \frac{\text{total distance travelled}}{\text{total time taken}}$$

Let s be the distance from x to y

Average speed

$$= \frac{s+s}{t_1+t_2} = \frac{2s}{\frac{s}{v_u} + \frac{s}{v_d}} = \frac{2v_u v_d}{v_d + v_u}$$

6. (c) $\lambda_A = 5\lambda$ and $\lambda_B = \lambda$

$$\text{At } t = 0, (N_0)_A = (N_0)_B$$

$$\text{Given, } \frac{N_A}{N_B} = \left(\frac{1}{e}\right)^2$$

According to radioactive decay,

$$\frac{N}{N_0} = e^{-\lambda t}$$

$$\therefore \frac{N_A}{(N_0)_A} = e^{-\lambda_A t} \dots (1)$$

$$\frac{N_B}{(N_0)_B} = e^{-\lambda_B t} \dots (2)$$

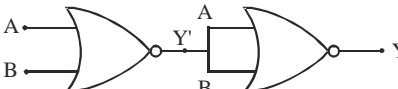
From (1) and (2)

$$\frac{N_A}{N_B} = e^{-(5\lambda - \lambda)t}$$

$$\Rightarrow \left(\frac{1}{e}\right)^2 = e^{-4\lambda t} = \left(\frac{1}{e}\right)^{4\lambda t}$$

$$\Rightarrow 4\lambda t = 2$$

$$\therefore t = \frac{1}{2\lambda}$$

7. (c) 

$$Y' = A + B$$

$$Y = A + B = A + B$$

Therefore truth table :

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

8. (a) In beta minus decay (β^-), a neutron is transformed into a proton, and an electron is emitted from the nucleus along with antineutrino.

$$n = p + e^- + \bar{\nu}$$

9. (d) Let
- $y = A \sin \omega t$

$$v_{\text{inst}} = \frac{dy}{dt} = A\omega \cos \omega t = A\omega \sin(\omega t + \pi/2)$$

$$\begin{aligned} \text{Acceleration} &= -A\omega^2 \sin \omega t \\ &= A\omega^2 \sin(\pi + \omega t) \end{aligned}$$

$$\therefore \phi = \frac{\pi}{2} = 0.5\pi$$

10. (a) In mass spectrometer, when ions are accelerated through potential
- V

$$\frac{1}{2}mv^2 = qV \quad \dots\dots(i)$$

As the magnetic field curves the path of the ions in a semicircular orbit

$$Bqv = \frac{mv^2}{R} \Rightarrow v = \frac{BqR}{m} \quad \dots\dots(ii)$$

Substituting (ii) in (i)

$$\frac{1}{2}m \left[\frac{BqR}{m} \right]^2 = qV$$

$$\text{or } \frac{q}{m} = \frac{2V}{B^2 R^2}$$

Since V and B are constants,

$$\therefore \frac{q}{m} \propto \frac{1}{R^2}$$

11. (a) Since,
- $\theta = \omega_0 t + \frac{1}{2}\alpha t^2$

Where α is angular acceleration, ω_0 is the initial angular speed.

$$t = 2\text{ s}$$

$$\theta = 2 \times 2 + \frac{1}{2} \times 3(2)^2 = 4 + 6 = 10 \text{ rad}$$

12. (d) Since
- $\phi_{\text{total}} = \phi_A + \phi_B + \phi_C = \frac{q}{\epsilon_0}$

Where q is the total charge.

As shown in the figure, flux associated with the curved surface B is $\phi = \phi_B$

Let us assume flux linked with the plane surfaces A and C be

$$\phi_A = \phi_C = \phi'$$

Therefore,

$$\frac{q}{\epsilon_0} = 2\phi' + \phi_B = 2\phi' + \phi$$

$$\Rightarrow \phi' = \frac{1}{2} \left(\frac{q}{\epsilon_0} - \phi \right)$$

13. (b) By using
- $v = n\lambda$

Here, $n = 2 \times 10^{14} \text{ Hz}$

$$\lambda = 5000 \text{ \AA} = 5000 \times 10^{-10} \text{ m}$$

$$v = 2 \times 10^{14} \times 5000 \times 10^{-10} = 10^8 \text{ m/s}$$

refractive index of the material,

$$\mu = c/v = \frac{3 \times 10^8}{10^8} = 3$$

14. (a) The difference in mass of a nucleus and its constituents,
- Δm
- , is called the mass defect and is given by

$$\Delta M = [ZM_p + (A - Z)M_n] - M$$

and binding energy = ΔMc^2

$$= [ZM_p + (A - Z)M_n - M]c^2$$

15. (b) Power dissipated =
- P

$$= \frac{V^2}{R} = \frac{(18)^2}{6} = 54 \text{ W}$$

16. (d) It has been known that a nucleus of mass number
- A
- has radius

$$R = R_0 A^{1/3}$$

Where $R_0 = 1.2 \times 10^{-15} \text{ m}$

and $A = \text{mass number}$

In case of ${}_{13}^{27}\text{Al}$, let nuclear radius be R_1

and for ${}_{32}^{125}\text{Te}$, nuclear radius be R_2

$$\text{For } {}_{13}^{27}\text{Al}, R_1 = R_0(27)^{1/3} = 3R_0$$

$$\text{For } {}_{32}^{125}\text{Te}, R_2 = R_0(125)^{1/3} = 5R_0$$

$$\frac{R_2}{R_1} = \frac{5R_0}{3R_0} = \frac{5}{3} R_1 = \frac{5}{3} \times 3.6 = 6 \text{ fm.}$$

17. (d) Friction is the retarding force for the block
- $F = ma = \mu R = \mu mg$

Therefore, from the first equation of motion

$$v = u - at$$

$$0 = v - \mu g \times t \Rightarrow \frac{v}{\mu g} = t$$

18. (c) Here,

$$f = f_0 \left(1 - \frac{t}{T}\right) \text{ or, } \frac{dv}{dt} = f_0 \left(1 - \frac{t}{T}\right)$$

$$\text{or, } dv = f_0 \left(1 - \frac{t}{T}\right) dt$$

$$\therefore v = \int dv = \int \left[f_0 \left(1 - \frac{t}{T}\right) \right] dt$$

$$\text{or, } v = f_0 \left(t - \frac{t^2}{2T} \right) + C$$

where C is the constant of integration.

At $t = 0$, $v = 0$.

$$\therefore 0 = f_0 \left(0 - \frac{0}{2T} \right) + C$$

$$\Rightarrow C = 0$$

$$\therefore v = f_0 \left(t - \frac{t^2}{2T} \right)$$

If $f = 0$, then

$$0 = f_0 \left(1 - \frac{t}{T} \right)$$

$$\Rightarrow t = T$$

Hence, particle's velocity in the time interval $t = 0$ and $t = T$ is given by

$$v_x = \int_{t=0}^{t=T} dv = \int_{t=0}^{t=T} \left[f_0 \left(1 - \frac{t}{T} \right) \right] dt$$

$$= f_0 \left[\left(t - \frac{t^2}{2T} \right) \right]_0^T$$

$$= f_0 \left(T - \frac{T^2}{2T} \right) = f_0 \left(T - \frac{T}{2} \right)$$

$$= \frac{1}{2} f_0 T.$$

19. (b) ~~Voltage gain~~ $= \beta \times \text{Impedance gain}$

$$50 = \beta \times \frac{200}{100} = 2\beta \Rightarrow \beta = 25$$

$$\text{and power gain} = \beta^2 \times \frac{200}{100} = 1250.$$

20. (a) A balanced wheatstone bridge simply requires

$$\frac{P}{Q} = \frac{R}{S}$$

$$\frac{2}{2} = \frac{2}{S}$$

Therefore, S should be 2Ω .

A resistance of 6Ω is connected in parallel.

In parallel combination,

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$\frac{1}{2} = \frac{1}{6} + \frac{1}{S}$$

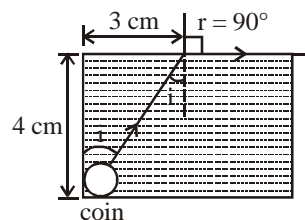
$$\Rightarrow S = 3\Omega$$

21. (c) By using $m = ZIt$

Where, Z is the electrochemical equivalent of copper.

$$\begin{aligned} \Rightarrow m &= 30 \times 10^{-5} \times 1.5 \times 10 \times 60 \\ &= 0.27 \text{ gm.} \end{aligned}$$

22. (d)



Hypotenuse comes out to be 5 cm.

$$\text{Since, } \frac{1}{\mu} = \frac{\sin i}{\sin 90^\circ}$$

$$\mu = \frac{1}{\sin i} = \frac{5}{3}$$

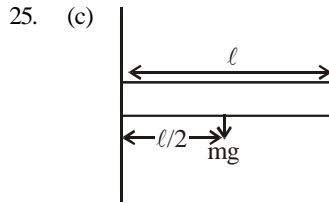
$$\text{Speed, } v = \frac{c}{\mu} = \frac{3 \times 10^8}{5/3} = 1.8 \times 10^8 \text{ m/s}$$

23. (b) Efficiency of the transformer

$$\eta = \frac{P_{\text{output}}}{P_{\text{input}}} \times 100 = \frac{100}{220 \times 0.5} \times 100 = 90.9\%$$

24. (c) Dimensions of Resistance,

$$R = \frac{[V]}{[I]} = \frac{[ML^2T^{-3}I^{-1}]}{[I]} = [ML^2T^{-3}I^{-2}]$$



Weight of the rod will produce torque,

$$\tau = mg \times \frac{\ell}{2}$$

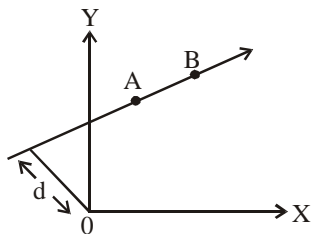
Also, $\tau = I\alpha$

Where, I is the moment of inertia = $\frac{m\ell^2}{3}$

and α is the angular acceleration

$$\therefore \frac{m\ell^2}{3} \alpha = mg \times \frac{\ell}{2} \Rightarrow \alpha = \frac{3g}{2\ell}$$

26. (a) Angular momentum = Linear momentum \times distance of line of action of linear momentum about the origin.



$L_A = P_A \times d$, $L_B = P_B \times d$
As linear momenta are equal, therefore, $L_A = L_B$.

27. (c) We have, $U + K = E$
where, U = potential energy, K = Kinetic energy, E = Total energy.
Also, we know that, in S.H.M., when potential energy is maximum, K.E. is zero and vice-versa.

$$\therefore U_{\max} + 0 = E \Rightarrow U_{\max} = E$$

Further,

$$K.E. = \frac{1}{2} m\omega^2 a^2 \cos^2 \omega t$$

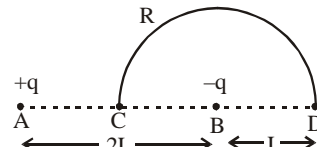
But by question, $K.E. = K_0 \cos^2 \omega t$

$$\therefore K_0 = \frac{1}{2} m\omega^2 a^2$$

Hence, total energy, $E = \frac{1}{2} m\omega^2 a^2 = K_0$

$$\therefore U_{\max} = K_0 \text{ \& } E = K_0.$$

28. (c)



Potential at C = $V_C = 0$

Potential at D = V_D

$$= K \left(\frac{-q}{L} \right) + \frac{Kq}{3L} = -\frac{2}{3} \frac{Kq}{L}$$

Potential difference

$$V_D - V_C = \frac{-2}{3} \frac{Kq}{L} = \frac{1}{4\pi\epsilon_0} \left(-\frac{2}{3} \cdot \frac{q}{L} \right)$$

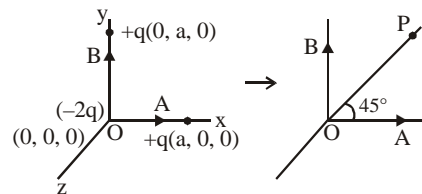
$$\Rightarrow \text{Work done} = Q(V_D - V_C)$$

$$= -\frac{2}{3} \times \frac{1}{4\pi\epsilon_0} \frac{qQ}{L} = \frac{-qQ}{6\pi\epsilon_0 L}$$

29. (d) Since $p = nhv$

$$\Rightarrow n = \frac{p}{hv} = \frac{2 \times 10^{-3}}{6.6 \times 10^{-34} \times 6 \times 10^{14}} = 5 \times 10^{15}$$

30. (a) Three point charges $+q$, $-2q$ and $+q$ are placed at points B ($x=0, y=a, z=0$), O ($x=0, y=0, z=0$) and A ($x=a, y=0, z=0$)
The system consists of two dipole moment vectors due to $(+q$ and $-q)$ and again due to $(+q$ and $-q)$ charges having equal magnitudes qa units – one along \overline{OA} and other along \overline{OB} . Hence, net dipole moment,
 $p_{\text{net}} = \sqrt{(qa)^2 + (qa)^2} = \sqrt{2}qa$ along \overline{OP} at an angle 45° with positive X-axis.



31. (b) Since orbital velocity of satellite is

$$v = \sqrt{\frac{GM}{r}}, \text{ it does not depend upon the}$$

mass of the satellite.

Therefore, both satellites will move with same speed.

32. (d) $|\vec{A} \times \vec{B}| = \sqrt{3}(\vec{A} \cdot \vec{B})$

$$\Rightarrow AB \sin \theta = \sqrt{3} AB \cos \theta$$

$$\Rightarrow \tan \theta = \sqrt{3} \Rightarrow \theta = 60^\circ$$

33. (a) Mass gets detached at the upper extreme position when pan returns to its mean position.

$$\text{At that point, } R = mg - m\omega^2 a = 0$$

$$\text{i.e. } g = \omega^2 a$$

$$\Rightarrow a = g / \omega^2 = mg / K$$

$$\Rightarrow a = \frac{2 \times 10}{200} \quad \left[A_s = \omega^2 = \frac{K}{m} \right]$$

$$\Rightarrow a = 1/10 \text{ m} = 10 \text{ cm}$$

34. (d) Magnetic moment, $m = IA$

$$= \frac{qv}{2\pi R} (\pi R^2) = \frac{qvR}{2}$$

$$\left[\because I = \frac{q}{T} \text{ and } T = \frac{2\pi R}{v} \right]$$

35. (d) Energy in the first excited state

$$= \frac{-13.6}{n^2} = \frac{-13.6}{2^2} = -3.4 \text{ eV}$$

But K.E. = -(Total energy) = +3.4 eV.

36. (d) Number of emitted electrons N_E

$$\propto \text{Intensity}$$

$$\propto \frac{1}{(\text{Distance})^2}$$

Therefore, as distance is doubled, N_E decreases by (1/4) times.

37. (b) Displacement from the mean position

$$y = a \sin\left(\frac{2\pi}{T}t\right)$$

According to problem $y = a/2$

$$a/2 = a \sin\left(\frac{2\pi}{T}t\right)$$

$$\Rightarrow \frac{\pi}{6} = \left(\frac{2\pi}{T}t\right) \Rightarrow t = T/12$$

This is the minimum time taken by the particle to travel half of the amplitude from the equilibrium position.

38. (c) For a cubic crystal,

$$a = b = c \text{ and } \alpha = \beta = \gamma = 90^\circ$$

39. (b) Work done = Change in energy

$$= \frac{1}{2} \left(C + \frac{C}{2} \right) V^2 = \frac{1}{2} \left(\frac{3C}{2} \right) V^2 = \frac{3CV^2}{4}$$

40. (a) According to Stefan's law,

$$E \propto T^4$$

$$\propto (t+273)^4 \text{ K} \quad [727^\circ\text{C} = (727+273)\text{K}]$$

$$\propto (727+273)^4 \text{ K}$$

$$\propto (1000)^4 \text{ K}$$

41. (a) We know

$$\frac{I}{I_s} = 1 + \frac{G}{S}$$

$$\frac{750}{100} = 1 + \frac{13}{S}$$

$$S \Rightarrow 2\Omega$$

42. (c) Since efficiency of engine is

$$\eta = 1 - \frac{T_2}{T_1}$$

According to problem,

$$\frac{1}{6} = 1 - \frac{T_2}{T_1} \quad \dots\dots\dots (1)$$

When the temperature of the sink is reduced by 62°C , its efficiency is doubled

$$2\left(\frac{1}{6}\right) = 1 - \frac{T_2 - 62}{T_1} \quad \dots\dots\dots (2)$$

Solving (1) and (2)

$$T_2 = 372 \text{ K}$$

$$T_1 = 99^\circ\text{C} = \text{Temperature of source.}$$

43. (c) Variation in magnetic field causes electric field and vice versa.

In electromagnetic waves, $\vec{E} \perp \vec{B}$. Both \vec{E} and \vec{B} are in the same phase.

In electromagnetic waves

$$E = E_0 \sin(\omega t - kx)$$

$$B = B_0 \sin(\omega t - kx)$$

The electromagnetic waves travel in the direction of $(\vec{E} \times \vec{B})$.

44. (d) Condition for which the current is maximum in a series LCR circuit is,

$$\omega = \frac{1}{\sqrt{LC}}$$

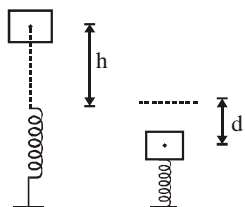
$$1000 = \frac{1}{\sqrt{L(10 \times 10^{-6})}}$$

$$\Rightarrow L = 100 \text{ mH}$$

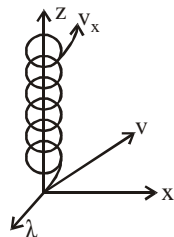
45. (d) Beyond curie temperature, ferromagnetic substances behaves like a paramagnetic substance.
46. (a) Gravitational potential energy of ball gets converted into elastic potential energy of the spring.

$$mg(h+d) = \frac{1}{2}kd^2$$

$$\text{Net work done} = mg(h+d) - \frac{1}{2}kd^2 = 0$$



47. (b)



When a test charge q_0 enters a magnetic field \vec{B} directed along z-axis, with a velocity \vec{v} making angles θ with the z-axis. The time period of the motion is independent of R and v .

48. (d) Since $T_n = \frac{T_i + T_c}{2}$ = Neutral temperature

$$T_n = \frac{T_i + 0}{2} = \frac{T_i}{2}$$

$[T_c = 0^\circ\text{C} = \text{temperature of cold junction}]$

49. (c) Power radiated by the sun at $t^\circ\text{C}$

$$= \sigma(t + 273)^4 4\pi r^2$$

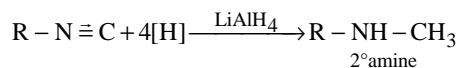
Power received by a unit surface

$$= \frac{\sigma(t + 273)^4 4\pi r^2}{4\pi R^2} = \frac{r^2 \sigma (t + 273)^4}{R^2}$$

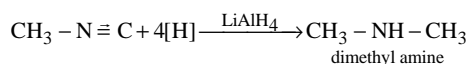
50. (d) For a P-type semiconductor, the acceptor energy level, as shown in the diagram, is slightly above the top E_v of the volume band. With very small supply of energy an electron from the valence band can jump to the level E_A and ionise acceptor negatively.

Chemistry

51. (a) Reduction of alkyl isocyanides in presence of LiAlH_4 yields secondary amines containing methyl as one of the alkyl group.

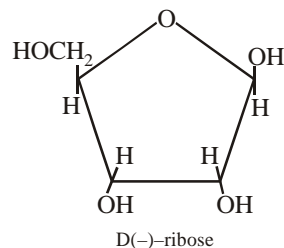


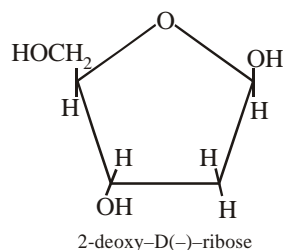
e.g.,



whereas, alkyl cyanides give 1° amine on reduction.

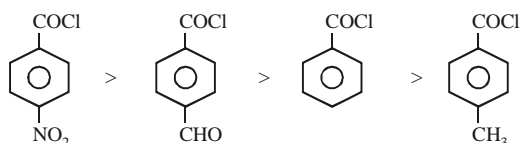
52. (c) Each nucleic acid consists of a pentose sugar a heterocyclic base, and phosphoric acid. The sugar present in DNA is 2-deoxy-D(-) ribose and the sugar present in RNA is D(-)- ribose. The chirality of DNA and RNA molecules are due to the presence of sugar components.



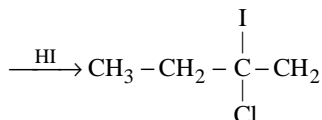
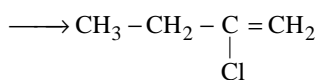
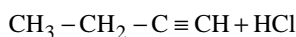


53. (a) Langmuir adsorption isotherm is based on the assumption that every adsorption site is equivalent and the ability of a particle to bind there is independent of whether or not nearby sites are occupied.
54. (a) Given $K_a = 1.00 \times 10^{-5}$, $C = 0.100$ mol for a weak electrolyte, degree of dissociation
- $$(\alpha) = \sqrt{\frac{K_a}{C}} = \sqrt{\frac{1 \times 10^{-5}}{0.100}} = 10^{-2} = 1\%$$
55. (d) As the slowest step is the rate determining step thus the mechanism B will be more consistent with the given information also because it involve one molecule of H_2 and one molecule of ICl it can expressed as $r = k [H_2][ICl]$ Which shows that the reaction is first order w.r.t. both H_2 & ICl .
56. (b) Efficiency of a fuel cell $(\eta) = \frac{\Delta G}{\Delta H}$
57. (d) This reaction shows the formation of H_2O , and the X_2 represents the enthalpy of formation of H_2O because as the definition suggests that the enthalpy of formation is the heat evolved or absorbed when one mole of substance is formed from its constituent atoms.
58. (a) As the basicity of metal hydroxides increases down the group from Be to Ba, the thermal stability of their carbonates also increases in the same order. Further group 1 compounds are more thermally stable than group 2 because their hydroxide are much basic than group 2 hydroxides therefore, the order of thermal stability is $BeCO_3 < MgCO_3 < CaCO_3 < K_2CO_3$.
59. (c) Hybridisation of Br is BrO_3^-
Total valence electrons = $7 + 3 \times 6 = 25$
Charge = -1 hence
- $$\text{Total} = 25 + 1 = 26$$
- $$= \frac{26}{8} = 3(Q) + 2(R) = 5$$
- hybridization = dsp^3
hybridization of Xe in XeO_3
Total valence electrons
- $$= 8 + 3 \times 6 = 26 = \frac{26}{8} = 3(Q) + 2(R) = 5$$
- Hybridization = dsp^3
In both cases, the structure is trigonal pyramidal.
60. (a) All the group IV elements show tetravalency which can be explained on the basis of shifting of one e^- of ns to the vacant np orbital. These four orbitals give rise to four sp^3 hybrid orbitals. When ns^2 electrons of the outermost shell do not participate in bonding it is called inert pair and the effect is called inert pair effect. The last three elements of group 4 i.e. Ge, Sn and Pb, have a tendency to form divalent as well as tetravalent ions. Since the inert pair effect increases from Ge to Pb, the stability of tetravalent ion decreases and that of divalent ion increases that is why Pb^{2+} is more stable than Pb^{4+} and Sn^{4+} ions is more stable than Sn^{2+} .
61. (d) The sulphide ore is roasted to oxide before reduction because the ΔG_f° of most of the sulphides are greater than those of CS_2 and H_2S , therefore neither C nor H can reduce metal sulphide to metal. Further, the standard free energies of formation of oxide are much less than those of SO_2 . Hence oxidation of metal sulphides to metal oxide is thermodynamically favourable.
62. (c) For a first order reaction
- $$k = \frac{2.303}{t} \log_{10} \frac{a}{a-x}$$
- when $t = t_{1/2}$
- $$k = \frac{2.303}{t_{1/2}} \log_{10} \frac{a}{a-a/2}$$
- or $t_{1/2} = \frac{2.303}{k} \log_{10} 2 = \frac{\ln 2}{k}$
63. (c) The degree of hydrolysis increases as the magnitude of positive charge on carbonyl group increases. Electron withdrawing

group increases the positive charge and electron releasing group decreases the negative charge. Among these NO_2 & CHO are electron withdrawing group from which NO_2 has more $-\text{I}$ effect than $-\text{CHO}$. On the other hand CH_3 is an electron releasing group therefore the order of reactivity towards hydrolysis is



64. (c) This reaction occurs according to Markownikoff's rule which states that when an unsymmetrical alkene undergoes hydrohalogenation, the negative part goes to that C-atom which contains a lesser number of H-atoms.



65. (c) Molarity of H_2SO_4 solution

$$= \frac{98 \times 1000}{98 \times 100} \times 1.84 = 18.4$$

Suppose V ml of this H_2SO_4 is used to prepare 1 lit. of 0.1M H_2SO_4

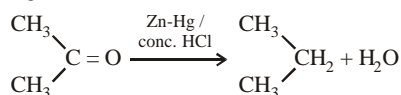
$$\therefore V \times 18.02 = 1000 \times 0.1$$

$$\text{or } V = \frac{1000 \times 0.1}{18.02} = 5.55 \text{ ml.}$$

66. (d) $\text{>C=O} \xrightarrow{\text{Zn-Hg / conc. HCl}} \text{>CH}_2 + \text{H}_2\text{O}$

Clemmensen reduction

e.g.



67. (b) $\frac{1}{2}\text{H}_2 + \frac{1}{2}\text{Cl}_2 \longrightarrow \text{HCl}$

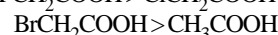
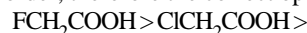
$$\Delta H_{\text{HCl}} = \sum \text{B.E. of reactant} - \sum \text{B.E. of products}$$

$$-90 = \frac{1}{2} \times 430 + \frac{1}{2} \times 240 - \text{B.E. of HCl}$$

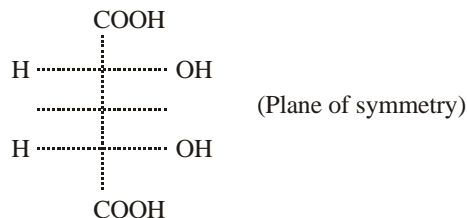
$$\therefore \text{B.E. of HCl} = 215 + 120 + 90 = 425 \text{ kJ mol}^{-1}$$

68. (c) Electron withdrawing substituent increases the acidity by increasing the ionic character of $-\text{O}-\text{H}$ by inductive effect. Electronegativity decreases in the order $\text{F} > \text{Cl} > \text{Br}$

and hence $-\text{I}$ effect also decreases in the same order, therefore the correct option is



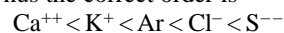
69. (a) Compounds which do not show optical activity in spite of the presence of chiral carbon atoms are called **meso-compounds**. The absence of optical activity in these compounds is due to the presence of a plane of symmetry in their molecules. e.g. meso-tartaric acid is optically inactive.



70. (b) R-configuration

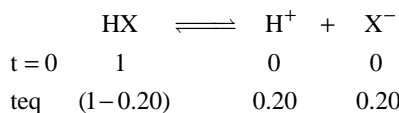
71. (d) Vitamin B is water soluble whereas all others are water insoluble.

72. (a) For isoelectronic species, size of anion increases as negative charge increases whereas size of cation decreases with increase in positive charge. Further ionic radii of anions is more than that of cations. Thus the correct order is



73. (b) As $\Delta T_f = i K_f m$

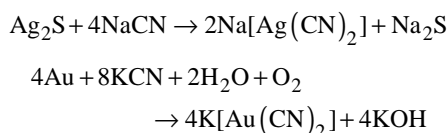
For



Total no. of moles = $1 - 0.20 + 0.20 + 0.20 = 1 + 0.20 = 1.2$

$\therefore \Delta T_f = 1.2 \times 1.86 \times 0.5 = 1.1160 \approx 1.12 \text{ K}$

74. (d) Leaching is the selective dissolution of the desired mineral leaving behind the impurities in a suitable dissolving agent eg Argentite or Silver glance, Ag_2S is an ore of silver. Silver is extracted from argentite by the mac-Arthur and Forest process (leaching process).



75. (a) For a first order reaction

$$k = \frac{2.303}{t} \log \frac{a}{a-x}$$

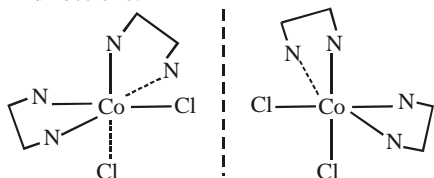
when $t = 60$ and $x = 60\%$

$$k = \frac{2.303}{60} \log \frac{100}{100-60} = \frac{2.303}{60} \log \frac{100}{40}$$

Now,

$$\begin{aligned} t_{1/2} &= \frac{2.303}{0.0153} \log \frac{100}{100-50} = \frac{2.303}{0.0153} \times \log 2 \\ &= \frac{2.303}{0.0153} \times 0.3010 = 45.31 \text{ min.} \end{aligned}$$

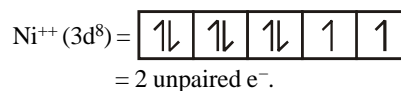
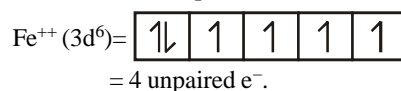
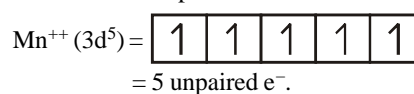
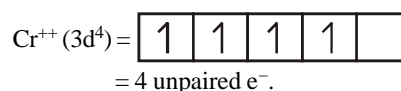
76. (b) Non superimposable mirror images are called optical isomers and may be described as "chiral". They are also called enantiomers and rotate plane polarised light in opposite directions.



77. (b) Since each Sr^{++} ion provides one cation vacancy, hence
Concentration of cation vacancies = mole % of SrCl_2 added
 $= 10^{-4}$ mole %

$$= \frac{10^{-4}}{100} \times 6.023 \times 10^{23} = 6.023 \times 10^{17}$$

78. (b) Lesser is the number of unpaired electrons smaller will be the paramagnetic behaviour. As Cr^{++} , Mn^{++} , Fe^{++} & Ni^{++} contains.

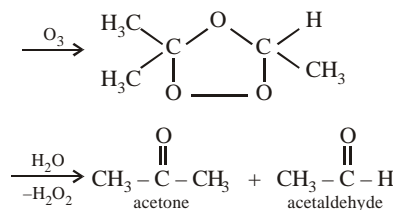


As Ni^{++} has minimum no. of unpaired e^- thus this is least paramagnetic.

79. (a) The solubility of sulphates of alkaline earth metals decreases as we move down the group from Be to Ba due to the reason that ionic size increases down the group. The lattice energy remains constant because sulphate ion is so large, so that small change in cationic sizes do not make any difference. Thus the order:



80. (d) $\text{H}_3\text{C}-\underset{\text{CH}_3}{\text{C}}=\text{CH}-\text{CH}_3$



81. (b) The factors on which the ionisation energy depend are :

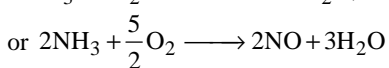
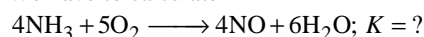
- Atomic size – I.E. decreases as the atomic size increases. So the attractive force decreases.
- Number of electrons in the inner shell (screening effect). As the number of shells increases screening effect also increases and hence the I.E. tends to decrease.

82. (a) Proton affinity decreases in moving across the period from left to right due to increase in charge, within a group the proton affinities decreases from top to bottom.

Nitrogen family > Oxygen family > Halogens

83. (d) Given,
 $N_2 + 3H_2 \rightleftharpoons 2NH_3; K_1$ (i)
 $N_2 + O_2 \rightleftharpoons 2NO; K_2$ (ii)
 $H_2 + \frac{1}{2}O_2 \rightleftharpoons H_2O; K_3$ (iii)

We have to calculate



$$\text{For this equation, } K = \frac{[NO]^2 [H_2O]^3}{[NH_3]^2 [O_2]^{5/2}}$$

$$\text{but } K_1 = \frac{[NH_3]^2}{[N_2][H_2]^3}, K_2 = \frac{[NO]^2}{[N_2][O_2]}$$

$$\& K_3 = \frac{[H_2O]}{[H_2][O_2]^{1/2}}$$

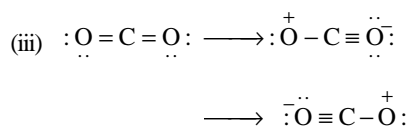
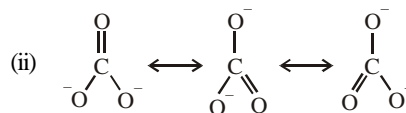
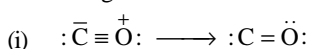
$$\text{or } K_3 = \frac{[H_2O]^3}{[H_2]^3 [O_2]^{3/2}}$$

Now operate,

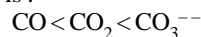
$$\begin{aligned} \frac{K_2 \cdot K_3^3}{K_1} &= \frac{[NO]^2}{[N_2][O_2]} \times \frac{[H_2O]^3}{[H_2]^3 [O_2]^{3/2}} \cdot \frac{[N_2][H_2]^3}{[NH_3]^2} \\ &= \frac{[NO]^2 [H_2O]^3}{[NH_3]^2 [O_2]^{5/2}} = K \end{aligned}$$

$$\boxed{\therefore K = \frac{K_2 \cdot K_3^3}{K_1}}$$

84. (d) For chromium ion + 3oxidation state is most stable.
 85. (c) All these structures exhibits resonance and can be represented by the following resonating structures.



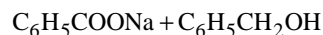
More is the single bond character. More will be the bond length. Hence, the correct order is :



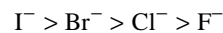
86. (d) $\underset{+1}{HO}Cl < \underset{+3}{HO}ClO < \underset{+5}{HO}ClO_2 < \underset{+7}{HO}ClO_3$

As the oxidation number of the central atom increases, strength of acid also increases.

87. (a) Aldehydes containing no α -hydrogen atom on warming with 50% NaOH or KOH undergo disproportionation i.e. self oxidation - reduction known as cannizzaro's reaction.



88. (a) Nucleophilicity increases down the periodic table.



89. (a) Given $[H_3O^+] = 1 \times 10^{-10} M$
 at 25° $[H_3O^+][OH^-] = 10^{-14}$

$$\therefore [OH^-] = \frac{10^{-14}}{10^{-10}} = 10^{-4}$$

$$\text{Now, } [OH^-] = 10^{-p^{OH}} = 10^{-4} = 10^{-p^{OH}} \\ \therefore p^{OH} = 4$$

90. (b) (ii) is not possible for any value of n because l varies from 0 to (n - 1) thus for n = 2, l can be only 0, 1, 2.
 (iv) is not possible because for l = 0, m = 0.
 (v) is not possible because for l = 2, m varies from -2 to +2.

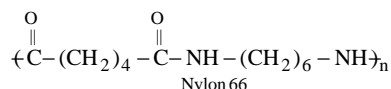
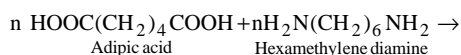
91. (c) As $E_{\text{cell}}^{\circ} = \frac{0.0591}{n} \log K_c$

$$\therefore 0.46 = \frac{0.0591}{2} \log K_c$$

$$\therefore \log K_c = \frac{2 \times 0.46}{0.0591} = 15.57$$

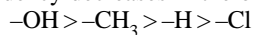
$$\text{or } K_c = \text{Antilog } 15.57 = 3.7 \times 10^{15} \approx 4 \times 10^{15}$$

92. (d) Copolymer of adipic acid (6C) and hexamethylene diamine (6C).

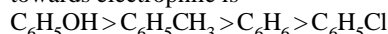


It has high tenacity and elasticity. It is resistant to abrasion and not affected by sea water. It is used for reinforcement of rubber tyres, manufacture of parachute, safety belts, carpets and fabrics.

93. (c) Electrophiles have high affinity for electrons. They attack at the site where electron-density is highest. Electron withdrawing substances increases the electron density. The electron withdrawing tendency decreases in the order :



Therefore, the correct order of reactivity towards electrophile is



94. (b) $(\text{SiO}_3^{2-})_n$ Two oxygen atoms per SiO_4 tetrahedron are shared giving polymeric anion chains.

Example : Spodumene $\text{LiAl}(\text{SiO}_3)_2$, Diposide $\text{CaMg}(\text{SiO}_3)_2$.

95. (d) Average isotopic mass of

$$\begin{aligned} X &= \frac{200 \times 90 + 199 \times 8 + 202 \times 2}{90 + 8 + 2} \\ &= \frac{18000 + 1892 + 404}{100} \\ &= \frac{19996}{100} = 199.96 \text{ amu} \end{aligned}$$

96. (d) Number of atoms per unit cell = 1
Atoms touch each other along edges.

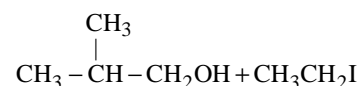
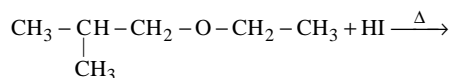
$$\text{Hence } r = \frac{a}{2}$$

(r = radius of atom and a = edge length)

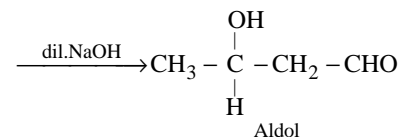
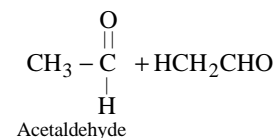
$$\text{Therefore \% fraction} = \frac{\frac{4}{3}\pi r^3}{(2r)^3} = \frac{\pi}{6} = 0.52$$

97. (c) In the cleavage of mixed ethers with two different alkyl groups, the alcohol and alkyl iodide that form depend on the nature of alkyl group. When primary or secondary alkyl groups are present, it is the lower alkyl

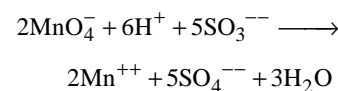
group that forms alkyl iodide therefore



98. (a) Aldehydes and ketones having at least one α -hydrogen atom in presence of dilute alkali give β -hydroxy aldehyde or β -hydroxy ketone



99. (b) The balance chemical equation is :



From the equation it is clear that

Moles of MnO_4^- require to oxidise 5 moles of SO_3^{--} are 2

Moles of MnO_4^- require to oxidise 1 mole of SO_3^{--} are $2/5$.

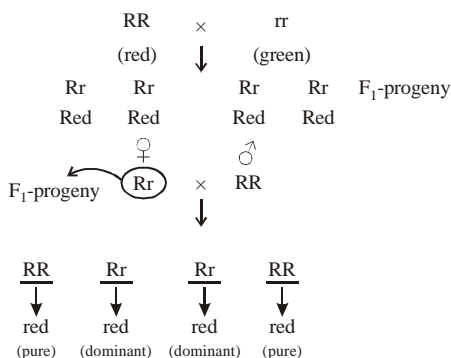
100. (b) There is a steady decrease in the radii as the atomic number of the lanthanide elements increases. For every additional proton added in nucleus the corresponding electron goes to $4f$ subshell.

The shape of f -orbitals is very much diffused and they have poor shielding effect. The effective nuclear charge increases which causes the contraction in the size of electron charge cloud. This contraction in size is **quite regular** and known as **Lanthanoid contraction**.

Since the change in the ionic radii in the lanthanide series is very small, thus their chemical properties are similar.

Biology

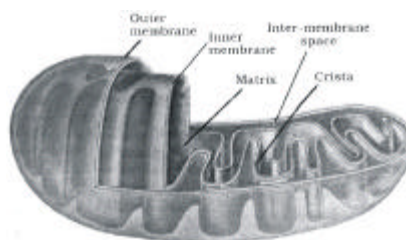
101. (a) ICBN (International code of Botanical Nomenclature) - It is one of the code of nomenclature which is independent of zoological and bacteriological nomenclature. The code applies equally to names of taxonomic groups treated as plants whether or not these groups were originally so treated.
102. (d) The class Basidiomycetes includes those members that produce their basidia and basidiospores on or in a basidiocarp.
103. (d) Biological organisms starts with submicroscopic molecular level like viruses, bacteria etc. These organisms are unable to be seen by naked eyes without the help of microscope or even electron microscope.
104. (d) Dachigam national park is for conservation of Hangul which is one of India's most scenically beautiful wildlife reserves. It is located only 22 kilometers from Srinagar, the capital city of the northern state of Jammu and Kashmir. It covers an area of 141 square kilometers consisting of some of the most scenic natural beauty present on Earth. The variation in altitude is vast, ranging from 5500 ft to 14000 ft above mean sea level. Due to this vast variation, the park is very clearly demarcated into an upper and lower region. The best times to explore these two areas are summer and winter respectively.
105. (a) Serum globulins → It makes 2 to 3% of plasma proteins. The a and b - globulin sent with the hormones to transport them the r-globulin from antibodies.
106. (c) crossing of one F_1 progeny with male parent. e.g



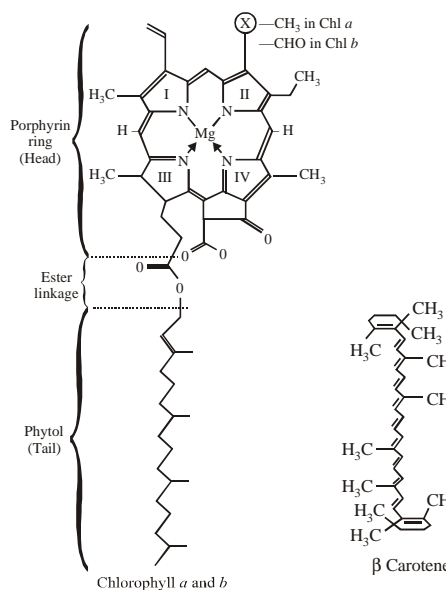
To find the genotype of hybrid test cross is done.

107. (c) okazaki fragments in DNA are linked up by the enzyme DNA ligase (DNA synthetase) after replacing the RNA primers with deoxyribonucleotides after replacing the RNA primers with deoxyribonucleotides solution of the okazaki fragments in DNA chain growth :
Replication occurs always in 5' – 3' direction okazaki fragments, synthesized on 3' – 5' DNA template, join to form lagging strand which grows in 3' – 5' direction.
108. (c) Ontogeny repeats phylogeny.
109. (b) Biochemical oxygen demand (BOD). If all the organic matter in one litre of water were oxidized by microorganisms. More value of BOD means the water sample is polluted by organic matter. BOD of distillary effluent is 40000 mg/L and that of paper mill effluent and sewage is 190 mg/L and 30 mg/L respectively
110. (c) The concept of chemical evolution is based on possible origin of life by combination of chemicals under suitable environmental conditions. The distribution of elements in the cosmos is the result of many processes in the history of the Universe. It provides us with a powerful tool to study the Big Bang, the density of baryonic matter, nucleosynthesis and the formation and evolution of stars and galaxies.
111. (d) MMC (megaspore mother cell) is surrounded by a callose wall, ovules generally differentiate single MMC in the micropylar region of MMC. It is a large cell containing dense cytoplasm and a prominent nucleus.
112. (c) Probiotics are defined as live microorganisms, including Lactobacillus species, Bifidobacterium species and yeasts, that may beneficially affect the host upon ingestion by improving the balance of the intestinal microflora. The dietary use of live microorganisms has a long history.
113. (d) Podophyllum (pode-oh-FILL-um) is one of the endangered species of Indian medicinal plants. Which used to remove benign (not cancer) growths, such as certain kinds of warts. It works by destroying the tissue of the growth.

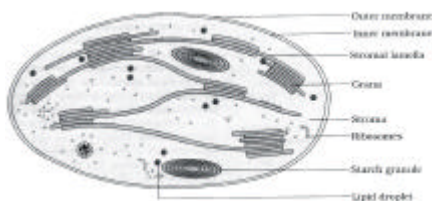
114. (a) Neries (belonging to class polychaeta of phylum Annelida) scorpion and cockroach (belonging to phylum arthropoda) and silver fish all have dorsal heart.
115. (b) There are several factors and processes which differentiate living beings with non-living beings like reproduction, respiration, growth, etc. But among them reproduction is the only difference which differentiate without any exception living being with non-living beings.
116. (c) Due to a long hunger strike and survival on water, a person will have less urea in his urine because urea comes to kidney as a waste product from liver which is formed after the breakdown of protein fat, carbohydrate during hunger. It is not synthesised but the synthesised ones are catabolised.
117. (a) The nucleosome model explains the packaging of histone proteins and DNA in the chromatin material which formsthe chromosome.
118. (b) A sequential expression of a set of human genes is the DNA sequence. Because gene is the functional part of DNA sequence.
119. (b) Recent years, the increases in toxic substances of NOx and/or SPM (Suspended Particulate Matter) from vehicles come to be serious problem. About the correlation between the traffic volume in our model and the real volume, we obtained the correlation coefficient of 0.74. Simultaneously, we got the result that the concentration of NOx was approximately 70 to 230 ppb. That of SPM was approximately 40 to 100 µg/m3.
120. (a) Both chloroplasts and mitochondria have an internal compartment, the thylakoid space bounded by double membrane



121. (a) Geometric representation of age structure a characteristic of population.
122. (a) The DNA binding sequence for RNA polymerase is called TATA box.
123. (b)

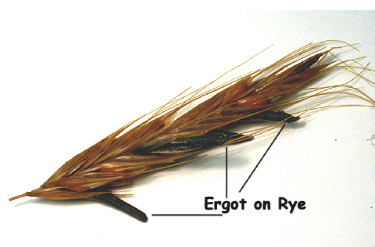


A plants require magnesium for chlorophyll synthesis All four sings bind with metal atom magnesium (Mg^{++}), Which remain present at the center of chlorophyll molecule.



124. (c) In the prothallus of a vascular cryptogams the antherozoids and eggs mature at different times which result in failurity of self-fertilization,
125. (c) Ergot of Rye is a plant disease that is caused by the fungus Claviceps purpurea. The so-called ergot that replaces the grain

of the rye is a dark, purplish sclerotium, from which the sexual stage, of the life cycle will form after over wintering.



126. (c) The finches of galapagos is lands provides an evidence in favour of biogeographical evolution
127. (a) *Physarum polycephalum* belongs to phylum Amoebozoa, infraphylum Mycetozoa, and class Myxogastrea. *P. polycephalum*, often referred to as the “many-headed slime,” is a slime mold that inhabits shady, cool, moist areas, such as decaying leaves and logs.
128. (b) If a population (e.g reindeer population) is allowed to grow in a predator free environment, the population grows beyond carrying capacity and there occurs population crash due to sudden shortage of food. such growth curves also occur in insect populations during rainy season, and in Algal blooms.
129. (d) It is also know as Australian pine, which is a deciduous tree with a soft, wispy, pine-like appearance that can grow to 100 feet or more in height. Also known as ironwood, beefwood, she oak and horsetail tree, it bears a superficial resemblance to the conifer genus *Pinus* because of its small, round, cone-like fruits and its branchlets of scale-like leaves that look like pine needles.
130. (c) *Pongamia pinnata* is one of the few nitrogen fixing trees (NFTS) to produce seeds containing 30-40% oil. It is often planted as an ornamental and shade tree but now-a-days it is considered as alternative source for Bio- Diesel. This species is commonly called pongam, karanja, or a derivation of these names. *Pongami*, *jatropha*, *Euphorbia* are

- petrocrops. However, in the Indian countryside, *pongamia*(kanjar) is being utilized as a source of biodiesel.
131. (a) Teak and pine is most suitable for the study of critical secondary growth because in secondary growth, secondary tissues are formed from lateral meristem which is well developed in these two cases and secondary growth occurs in gymnosperms and dicots.
132. (a) Fat soluble vitamins are - A, D, E and K and lack of vitamin A causes xerophthalmia.
133. (c) Movement of water will be from low DPD to high DPD i.e from A to B
134. (d) It is ciliated epithelium which bears numerous delicated hair like outgrowths the cilia, arising from basal granules. The cilia remains in rhythmic motion and creates current to transport the materials which comes in contact with them.
135. (d) It will be types of pigment present in the cell like Rhodophyceae presence of phycoerythrin chlorophyceae b high green algae presence of phycocyanin , green algae etc.
136. (c) It is calcium and phosphorus.
137. (d) Extensive use of chemical fertilizers may lead to eutrophication of nearby water bodies.
138. (c) The basic number (x) of wheat is 7 so,
 $6x = 2x = 42$ and $n = 21$
139. (d) The innermost layer of the cortex is called endodermis. It comprises a single layer of barrel shaped cells without any intercellular spaces
140. (d) Only birds and mammals are homoiothermous.
141. (c) Bowman’s glands are located in the olfactory epithelium of our nose
142. (c) Coliforms are a broad class of bacteria found in our environment, including the feces of man and other warm-blooded animals. The presence of coliform bacteria in drinking water may indicate a possible presence of harmful, disease-causing organisms.
143. (d) graafian follicle – the ovarian medulla contains many rounded or oval bodies, called ovarian, or grafian follicles, at various

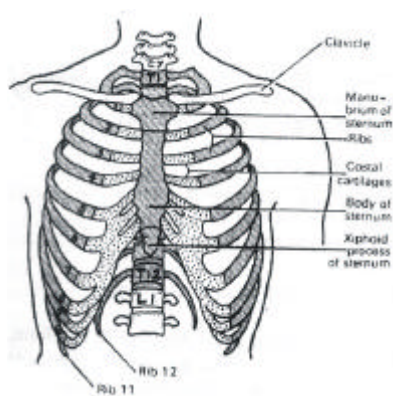
- stages of development. Each follicle contains a large ovum surrounded by many layers of follicle cells.
144. (c) Opening of floral buds into flowers, is a type of autonomic movement of water which is due to epinasty.
145. (a) Leech has ventral central nervous system which consists of nerve ring, and a solid, double, mid ventral nerve cord with ganglia.
146. (c) Succinate:ubiquinone oxidoreductase, also known in mitochondria as Complex II, provides a link between the citric acid cycle and the membrane-bound electron-transport system. The membrane extrinsic, water-soluble domain, known as succinate dehydrogenase (SDH), contains the fumarate/succinate active site with a covalently bound FAD group and three iron-sulfur clusters: $[2\text{Fe}-2\text{S}]^{2+/1+}$, $[4\text{Fe}-4\text{S}]^{2+/1+}$, and $[3\text{Fe}-4\text{S}]^{1+/0}$. The enzyme catalyzes the interconversion of fumarate and succinate, and is closely related to fumarate reductase
147. (c) The first acceptor electrons from an excited chlorophyll is quinone
148. (a) The fate of a cell describes what it will become in the course of normal development. The fate of a particular cell can be discovered by labelling that cell and observing what structures it becomes a part of. The developmental potential, or potency, of a cell describes the range of different cell types it can become. The zygote and its very early descendents are totipotent - these cells have the potential to develop into a complete organism. The determination of different cell types (cell fates) involves progressive restrictions in their developmental potentials. Differentiation follows determination, as the cell elaborates a cell-specific developmental program. Differentiation results in the presence of cell types that have clear-cut identities, such as muscle cells, nerve cells, and skin cells.
149. (b) While working at the Rockefeller Institute, Brown reported isolation of a PPLO from human arthritic joint tissue in 1938. In 1949, Diennes reported to the 7th International Rheumatology Congress the isolation of PPLO from the genitourinary tracts of men afflicted with arthritis. In discussing the significance of this observation, Brown reported successful treatment of arthritic patients in 1949 with a new antibiotic called aureomycin (Clark, 1997).
150. (d) From *Pinetada vulgaris*, pearl is obtained.
151. (d) Parathyroid disorders : It causes the lowering of blood calcium level. This increases the excitability of nerves and muscles causing cramps and convulsions.
152. (d) *Pseudomonas putida* (super bus) developed by genetic engineering by Anand mohan chakravorty, is used to control oil spills.
153. (d) C_4 plants, C_4 cycle occurs in mesophyll cells and C_3 - cycle occurs in abundle sheath.
154. (c) Riccia, dryopteris and cycas The male gametes of bryophytes are biflagellate, and those of pteridophytes are multiflagellate, except selaginella having biflagellate gametes. The male gametes of gymnosperms are non motile except those of cycas having multiciliate gametes.
155. (d) a normal distributon.
156. (d) It was given by Geneticists George W. Beadle and E. L. Tatum which states that each gene in an organism controls the production of a specific enzyme. It is these enzymes that catalyze the reactions that lead to the phenotype of the organism.
157. (c) When the linked genes are situated quite close, the chances of crossing over are highly reduced. Due to this, large number os parental gametes are formed and only few recombinant gametes are formed. This results in higher number of parental types in F_2 generation as compared to recombinants.
158. (a) In cloning of cattle, a fertilized egg is taken out of the mother's womb and in the eight cell - stage , cells are separated and cultured until small embryos are formed which are implanted into the womb of other cows.
159. (b) Ultrasound imaging has frequency range 1 - 15 MHz which has become part of our lives in the last decade. We are now all

familiar with the blurry black and white sonograms (ultrasound pictures) that show the unborn baby inside the mother's uterus. Although it may take a little imagination on our part to understand that a round circle is the baby's head, that does not prevent a proud mother-to-be from showing off her first baby picture.

160. (d) When the members of a species are inter-fertile and produce fertile offsprings.
161. (b) Inheritance of skin colour in human is controlled by three genes, A B and C which is polygenic in heritance.
162. (c) The analogous organs show comergent evolution due to similar adaptations which do not support organic evolution.
163. (b) pollen-grains of many species are responsible for some of the severe allergies and bronchial affliction in some people often lead to chronic respiratory disorders - asthma, bronchitis.
164. (d) Homo habilis had a cranial capacity in the range of 680 - 720 c.c & that of . homo erectus erectus 775 - 990 c.c., Homo erectus pekinesis 915-1200 c.c. Homo nenderthalensis 1300-1600 c.c.
165. (d) During the period when the number of coal-burning factories in England was increasing (during the so-called Industrial Revolution) it was noticed that the number of melanic individuals of the species of Peppered Moth (*Biston betularia*) was becoming more common. Originally rare in the population of normally light-colored moths, the frequency of the melanic form increased in polluted areas until it was over 90%. This change in color has come to be known as "industrial melanism."
166. (a) It is competition between individuals of different species. The interspecific competition may be very severe because all the members of a species have similar requirements of food, habitat mate, etc and they also have similar adaptations to get their needs.
167. (a) Blood serum is liquid minus clotting elements of pale yellow colour. It does not have fibrinogen and other clotting materials. It does not take part in blood

clotting.

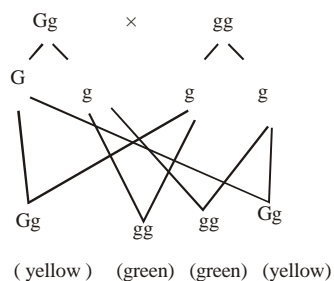
168. (d) They are found in the equatorial regions rainfall exceeds 140 cm.) The warm humid ~~climate supports~~ **broad leaved evergreen plants**. Productivity is very high (12000 k. cal/m²/ year The vegetation show stratification into two or more well defined layers.
169. (d) Floating ribs are 2- pairs (11th and 12th pair) which are not attached to sternum



170. (c) A highly conserved repetitive DNA sequence, (TTAGGG)_n, has been isolated from a human recombinant repetitive DNA library. Telomerase seals the ends of the chromosomes
171. (d) Elater: Which is an elongated, spirally thickened, water-attracting cell in the capsule of a liverwort, derived from sporogenous tissue and assisting in spore dispersal.
172. (c) Essential micro elements are Fe, Mn, Zn, B, Cu, Mo and essential macronutrients are C, H, N, P, S, Ca, K, Mg
173. (d) Glycolysis, krebs cycle and electron transport system, they all give ATP which is the main energy currency of our body. Glycolysis takes place in cytoplasm kreb's cycle also in cytoplasm and ETS takes place in the mitochondria.
174. (a) Adaptive radiation refers to evolution of different species from a common ancestor. The mammals are adapted for different mode of life i.e. they show Adaptive radiation. They can be aerial (bat), aquatic

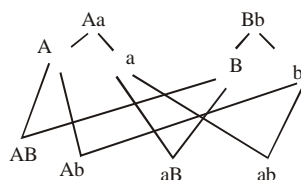
(whale and dolphins), burrowing or fossorial (rat), cursorial (horse), scantorial (squirrel) or arboreal (monkey). The adaptive radiation, the term by osborn, is also known as Divergent evolution.

175. (a) Gibberlic acid stimulates cell growth of leaves and stem causing their expansion, elongation respective and leaf fall is controlled by ABA.
176. (a) To survive in a particular environment, an organism need to adapt in that environment. If the organism becomes success in adapting them that organism is selected by nature .
177. (a) Generative cell which is a cell of the male gametophyte or pollen grain in seed plants that divides to give rise directly or indirectly to sperm
178. (d) Let GG \Rightarrow homozygous yellow seeded plant.
 gg \Rightarrow homozygous green
 Gg \Rightarrow heterozygous green
 According to the question :



So, the ratio cell be 50 : 50

179. (c) Since RBCS do not have mitochondria so they can respir only anaerobically
180. (d)



So, the corresponding genstype cell be AaBb.

181. (b) The analogous organs show convergent evolution due to samilar adaptation. They

do not support organic evolution whole seadandshark shows convergent evolution due to similar habitate.

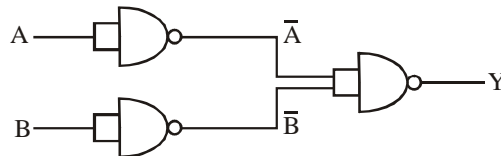
182. (b) Speciation takes place via reproductive isolation which is the most important consequence of geographical isolation.
183. (a) Lysozyme is an antibacterial agent which is secreted by the major salivary glands.
184. (b) The progesterone and estradiol continue the hypertrophy of endo metrial lining in the uterus and fallopian tubes and maintain it throughout pregnancy. progesterone is also necessary for the proper implantation of the foetus in the uterine wall. It stimulates the endometrial glands to secrete a nutrient fluid for the foetus, hence the term setactory phase. The progesterone inhibits the release of FSH so that it may not develop additional follicles and eggs.
185. (b) Proline is an amino acid which is a constituent part of a cell membrane.
186. (b) The bullock is castrated and therefore secretion of testosterone is not adequate
187. (d) Once the events of depolarization have occurred, a nerve impulse or spike is initiated. Action potential is another name of nerve impulse. It lasts about 1 msec (millisecond). The stimulated, negatively charged point on the outside of the membrane sends out an electrical current to the positive point (still polarized adjacent to it. This local current causes the adjacent inner part of the membrane to reverse its potential from $-70m v$ to $+30m v$. The reversal repeats itself over and over until the nerve impulse is conducted through the length of the neuron.
188. (a) Exotic Species - a species that has been introduced from another geographic region to an area outside its natural range. Examples are water hyacinth, Lantana camera
189. (c) The fertile region of microsporophyll bears a number of microsporangia or pollen sacs arranged in sori. The pollen chamber represents microsporangium in which pollen grains develop.
190. (d) The process of formation of protein sequence from DNA strand is called

- transcription which requires RNA polymerase chain. RNA polymerase chains are of 3-types in eukaryotes
- (i) RNA polymerase-I
 - (ii) RNA polymerase-II
 - (iii) RNA polymerase-III
191. (d) When the set point of hypothalamus is disturbed by high temperature, it stimulates vasodilation and sweating while in low temperature there is vasoconstriction and shivering
 192. (b) The two chains are antiparallel, one aligned in 5' → 3' direction the other in 3' → 5' direction.
 193. (d) Crocodile belongs to reptilia class which has four chambered heart. Lemur teeth are embedded in the sockets of two which is known as there don't. In Obelia polyps reproduce medusae asexually and medusae form the polyps sexually. Such alternation of asexual and sexual phases in the life cycle of Obelia is called metagenesis.
 194. (d) The cytoplasm immediately surrounding the nucleus is loaded with protein synthetic machinery and is called perikaryon. Dendrites are usually shorter, tapering and much branched processes which may be one to several. These two are only present in nerve cells.
 195. (a) Hybrid vigour is also called Heterosis which is measured in terms of size growth rate / yield and number of other characters. Hybridisation increases vigour and fertility. It is exploited by crossing of two inbred parental lines. It is best maintained in vegetatively reproducing crops because of genetic recombinations.
 196. (b) Newcastle disease (ND) is a highly contagious, generalised virus disease of domestic poultry and wild birds characterised by gastro-intestinal, respiratory and nervous signs.
 197. (a) The Pr form: It absorbs light between 660 to 680nm and absorbs at a peak of 666 nm. It is the form synthesized in dark-grown seedlings. When Pr absorbs red light, it is converted to the Pfr form
 198. (b) Stone flies are not bio indicators. Bioindicators provide a range of techniques to assess the impacts of air pollution from reactive nitrogen (N) compounds on statutory nature conservation sites. They complement physical monitoring of atmospheric concentrations and deposition and risk assessment based on the critical loads approach by providing site-based information on atmospheric N concentrations, N deposition and/or ecological impacts.
 199. (a) It is commonly called as '**emergency hormone**' or 3F-hormone (For fear, fight & flight). Its secretion is regulated by SNS, and not by pituitary as in case of adrenal cortex. It stimulates sweating, heart beat and breathing rate. It causes the dilation of coronary artery (supplying blood to the heart muscles), bronchioles (for increasing inspiratory volume) and pupil (for better vision)
 200. (d) The effect of gibberellins had been known in Japan since early 1800 where certain rice plants were found to suffer from bakane or bakanae (foolish seedling) disease. Such rice plants were thin, pale green, spindle-shaped, longer by 50% than the healthy plants, and were sterile.

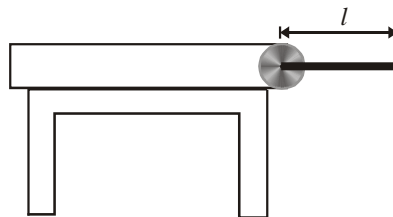
CBSE PMT – 2007 MAINS

PHYSICS

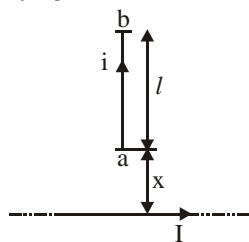
1. (a) How many photons of wavelength 439 nm should strike on a perfectly reflecting surface in 1 second so that it may exert a force of 10N?
 (b) Can water be boiled without heating?
2. (a) Equation for two waves is given as $y_1 = a \sin(\omega t + \phi_1)$, $y_2 = a \sin(\omega t + \phi_2)$. If amplitude and time period of resultant wave does not change then calculate $(\phi_1 - \phi_2)$.
 (b) A solid sphere of radius a having charge q is placed inside spherical shell of inner radius r , outer radius R .
 Find potential at distance x , where $r < x < R$.
3. (a) Prove that for a monoatomic gas ratio of specific heat $\gamma = 5/3$
 (b) Give the truth table of the following



4. (a) Write the difference between nuclear force and coulombic force.
 (b) An airplane is moving horizontally with speed of 100 m/sec at height of 2000 m from ground. A small object is detached from it and strikes the ground. Calculate the angle from vertical with which it strikes the ground.
 (c) Which of the following quantities have same dimensional formula?
 Angular momentum, impulse, energy, torque, force and moment of inertia.
5. (a) From a table, a rod is hinged as shown in the figure. When the support is withdrawn calculate the acceleration of center of mass.



- (b) There are two wires each produces frequency of 500Hz. By what percentage tension in one wire is increased so that 5 beats per second can be heard?
6. (a) Find the force on conductor carrying current i as shown the figure.



- (b) A conducting cone is given charge q . How will the charge density and electric potential varies at different points of cone?

7. (a) When 4 amp current flows through battery from positive to negative terminal potential difference is 12V obtained, when 2 amp current passes from negative to positive terminal of the battery potential difference 9V is obtained, calculate emf and internal resistance of the battery.
- (b) A small pulley of radius 20 cm and moment of inertia 0.32 kg m^2 is used to hang a 2kg mass with the help of a massless string. If this load is released then calculate acceleration of the block.



8. (a) Capacitance of $6\mu\text{F}$ is charged by 6V battery. Now it is connected with inductor of 5mH. Find current in inductor when 1/3rd of total energy is magnetic.
- (b) An object is thrown vertically upward with some speed. It crosses two points p , q which are separated by h metre. If t_p is the time between p and highest point and coming back and t_q is the time between q and highest point and coming back, relate acceleration due to gravity t_p , t_q and h .
9. (a) Two coils m & n having 10 turns and 15 turns respectively are placed close to each other. When 2A current is passing through coil m , then flux linked in coil n is 1.8×10^{-4} Weber per turn. If 3A current is passed through coil n then, calculate the flux linked per turn of coil m .
- (b) A string having tension 360N and mass /length = $4 \times 10^{-3} \text{ kg/m}$. It produces two consecutive resonant frequencies with a tuning fork, which are 375 Hz and 450 Hz. Find mass of string.
10. (a) In photoelectric effect a photon of wavelength 3300\AA is incident on metal surface of work function 2.5eV. Now emitted electrons enter in a transverse magnetic field $6.7 \times 10^{-6} \text{ T}$ and turn in a circular path of radius 50 cm. Calculate charge of electron from the given data?
- (b) If temperature and magnetic field applied across paramagnetic substance are tripled, how many times intensity of magnetization of substance will change?

CHEMISTRY

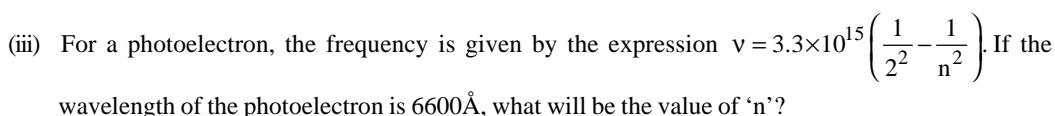
11. (i) Two silver rods are dipped in 1M HCl and 1M HNO_3 . In which of the two acids will the silver rods dissolve under standard conditions? Given: $E_{\text{Ag}/\text{Ag}^+}^0 = -0.79 \text{ volt}$, $E_{\text{NO}_3^-/\text{NO}}^0 = +0.96 \text{ volt}$.
- (ii) A 0.1M acetic acid solution ionizes to 1.2%. What is its K_a ?
12. (i) Why NH_3 is more soluble in water than PH_3 ?
- (ii) Why BH_3 dimerizes but BF_3 does not?
- (iii) The complex $\text{K}[\text{PtCl}_3\text{C}_2\text{H}_4]$ has 3 chlorine atoms bonded to platinum. Why is the chlorine atom lying opposite to ethene have higher bond length?
13. (i) An electron in which orbit of lithium will have same energy as an electron in the second orbit of hydrogen?



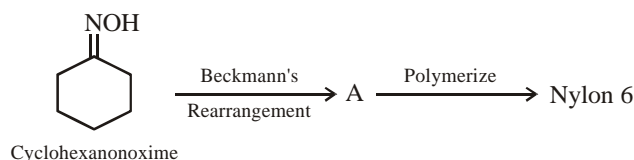
What is the order of the reaction with respect to I_2 ? Also give the total order.

$[I_2]$ Mol/ltr	$[CH_3COCH_3]$ Mol/ltr	$[H^+]$ Mol/ltr	Rate Mol/ltr sec
3×10^{-3}	2.5×10^{-2}	1.5×10^{-3}	2×10^{-2}

Also find the value and unit of the rate constant from the data given above.



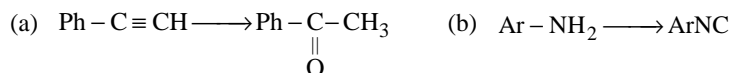
14. (i) Complete the reaction given below



- (ii) Identify which of the following given compounds is optically active?

- (a) 2-chloro 3-methyl pent -1, 4-diene (b) 3-methyl 3-hydroxy pentanol
(c) 2-chloro 2-methyl butane

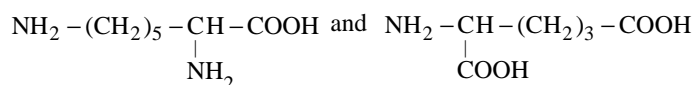
- (iii) Convert:



- (iv) An alkene C_4H_8 reacts with HBr both in the presence and absence of peroxides to give the same product. Identify the alkene.

15. (i) $C_4H_{10}O$ is produced on reaction of an alkane with H_2O/H_2SO_4 , which is not resolvable into optical isomers. Identify the compound?

- (ii) Make two possible dipeptides from the amino acids given below:



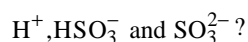
- (iii) The amino acid alanine when kept in a solution with pH less than its isoelectric point it coagulates at the cathode and if pH is greater than isoelectric point it coagulates at anode. Explain this phenomenon.

- (iv) Which out of 1-Butene and 2-Butene react easily with Br_2 in CS_2 and why?

16. (i) Why 1-Butyne gives sodium salt with $NaNH_2$ but 2-butyne does not?

- (ii) Draw the structures for DNA purines?

17. (i) For 0.5 M H_2SO_3 solution $K_{a_1} = 1.8 \times 10^{-2}$ and $K_{a_2} = 8.3 \times 10^{-5}$. Find the concentrations of



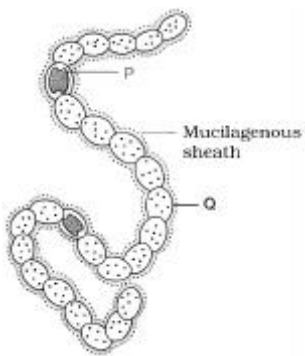
- (ii) N_2O_4 dissociates with a degree of dissociation as 0.4. Establish K_χ . Relation between K_χ and K_p and the value of K_p . Given total pressure = 1 atm and $T = 315 \text{ K}$.

- (iii) 1 Mole of nitrogen and 4 mole of hydrogen react to form ammonia in a 20 litre vessel. 10 litres of water are added and the vessel properly shaken. What will be the pressure of the residual gases?

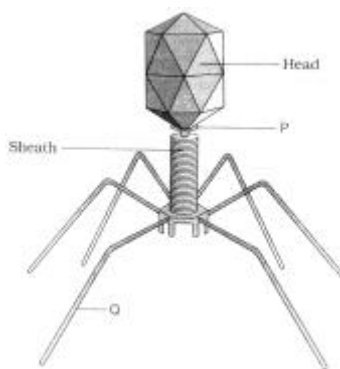
18. (i) Why is F_2 more reactive than Cl_2 ?
- (ii) Why is CrO_4^{2-} more oxidizing than MoO_4^{2-} ?
- (iii) Out of $(SiH_3)_2O$ and $(CH_3)_2O$ which is more basic and why?
19. (i) The empirical formula of an insoluble compound is $PtCl_2 \cdot (NH_3)_2$. On churning this compound with $AgNO_3$ we get $[Pt(NH_3)_4]Cl_2$ and $Ag_2[PtCl_4]$. What will be the molecular formula of the compound will be?
- (ii) Out of trimethyl amine and triethyl phosphine, which one has higher dipole moment?
20. (i) Why PO_4^{3-} ions exist but NO_4^{3-} ions don't?
- (ii) Why B_2 is paramagnetic but C_2 is not?
- (iii) For a octahedral fields splitting $\Delta_0 > P$ when the pairing energy is less and $\Delta_0 < P$ when pairing energy is higher. Explain the spin magnetic moments acquired by d^5 and d^6 configurations of metal ions in this field.

BIOLOGY

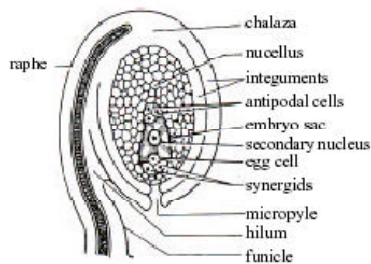
21. Write the location and function of the following
- (a) Cytoskeleton (b) Phytol chain
 (c) Synergid (d) Sieve tube element
 (e) Centromere
22. Refer the following diagrams (a) to (e) :



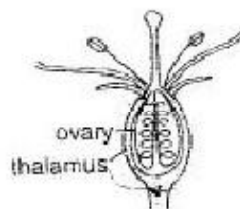
(a)



(b)



(c)



(d)



(e)

- (a) What is shown in diagram (a)? What are (P) and (Q)?
 (b) Tell whether the diagram (b) is T₁-phage or T₂-phage? What are (P) and (Q)?
 (c) Which type of ovule is shown in diagram (c)? Give one reason.
 (d) What is the type of flower called given in diagram (d)? Give examples of such flower.
 (e) Which type of aestivation is shown in (e)? Give examples?
23. Write down the types of placentation, inflorescence and fruit of the following
 (a) Pea (b) Coriander
 (c) Wheat (d) Sunflower (e) Mustard
24. Differentiate between the following [Give one important difference]
 (a) Culm and Caudex (b) Slime moulds and Fungi
 (c) Cyathium and Hypanthodium (d) Biological magnification and eutrophication
 (e) White rust and Brown rust.
25. Match the column-I and Column-II :
- | | |
|------------------------------------|-----------------------------|
| Column-I | Column-II |
| (a) Jacob and Monod | (i) Neurospora |
| (b) One gene one enzyme hypothesis | (ii) Operon |
| (c) Griffith | (iii) Reverse Transcriptase |
| (d) Temin and Baltimore | (iv) Okazaki fragments |
| (e) DNA polymerase | (v) Transformation |
| | (vi) Transduction |
| | (vii) Conjugation |
26. Fill in the blanks with suitable words given in boxes:

Marsilea	Coralloid root	Usnea		Eichhomia
Monoecious		Pneumatophores	Geitonogamy	Cycas
Pinus	Dioecious	Vivipary	Xenogamy	Oscillatoria

- (a) Rhizophora has both _____ and _____
 (b) Aquatic plants are _____ (Pteridophyte) and _____ (Angiosperm)
 (c) Plant bearing both male and female flowers is called _____ and the pollination between different flowers of the same plant is called _____.
 (d) _____ has _____.
27. (a) Give any two conditions for seed habit.
 (b) Among the pairs which one shows the tendency of seed habit?
 (i) Lycopodium and Equisetum
 (ii) Selaginella and Pteris.
 (iii) Dryopteris and Pteridium.
 (c) Suggest three ways to break seed dormancy.
28. Fill in the blanks
 (a) Mutation can be defined as _____ variation.
 (b) Mutation leads to evolution of _____ of a gene.
 (c) Genes expressed only in homozygous state are _____.
 (d) When both alleles of a gene are expressed it is _____.
 (e) Gene, which is most frequent is _____ type.
29. (a) Who discovered photoperiodism?
 (b) Select one SDP and one LDP from following plants
 Chrysanthemum , Rice, Spinach, Barley, Radish
 (c) Who gave the term 'Phytochrome'? Give one specific feature of phytochrome.

30. Match the Column-I and Column-II

Column-I

- (a) Indian Rhinoceros
- (b) Acid rain
- (c) Somaclonal variations
- (d) Protoplasm fusion
- (e) Biopiracy

Column-II

- (i) Extinct
- (ii) Endangered
- (iii) Gir forest
- (iv) Corbett National Park
- (v) CFC
- (vi) Nitrogen oxide
- (vii) Sulphur oxide
- (viii) PEG
- (ix) Mutation
- (x) Tumeric

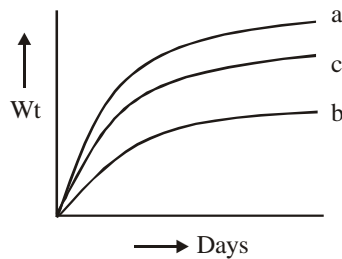
31. Differentiate between

- (a) Habitat and Niche
- (b) Flora and Vegetation

32. Answer the following question:

- (a) Apart from CO₂, name other green house gases
- (b) What is the type of movement of twiner and opening of flower?

33. Three groups of baby mice



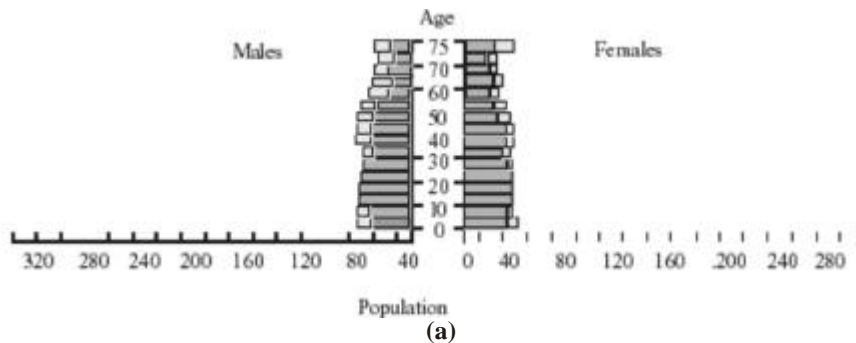
- (a) kept on complete diet
- (b) fed basal diet without nutrient to be tested
- (c) basal diet + carotene by feeding carrots

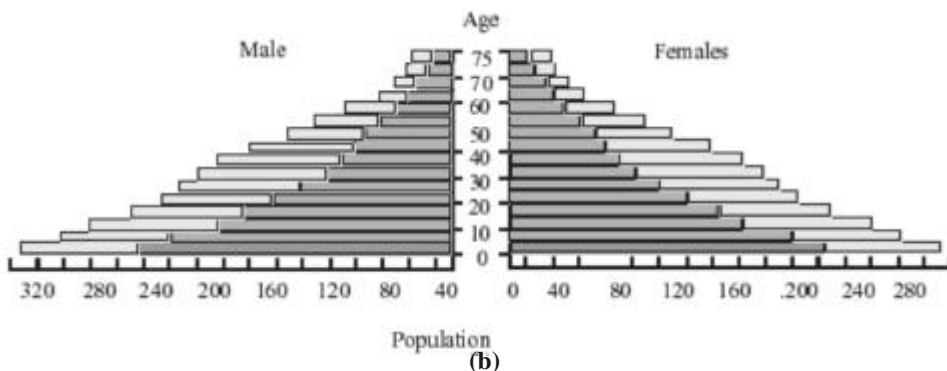
34. Out of following animals – answer the questions.

Whale, Earthworm, Bat, Starfish, Scorpion, Honey bee, Peafowl.

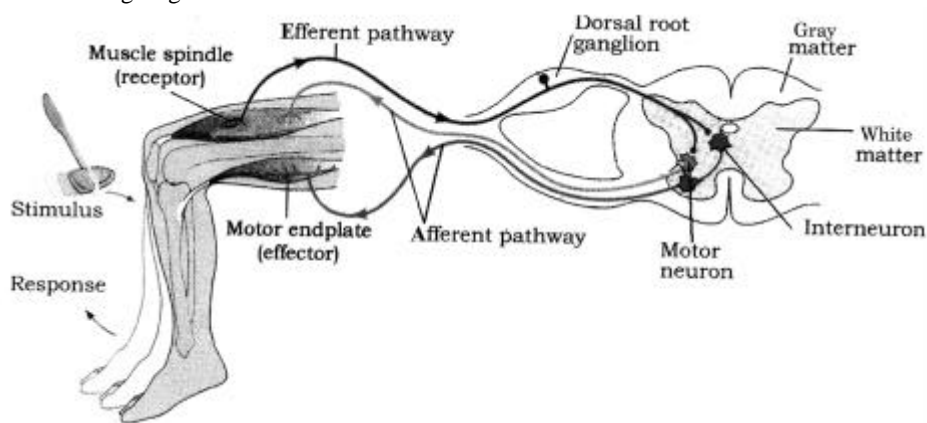
- (a) Which animal is different from rest of animals?
- (b) How many of these are poisonous, which class they belong to?
- (c) Which animals belong to same class?
- (d) Which animals are only representatives of their phylum?
- (e) Which of the following have 3 ear ossicles. Name the ossicles in the order of sound transmission.

35. The following diagrams represent Age-Sex pyramid of (a) developed (b) developing nation.

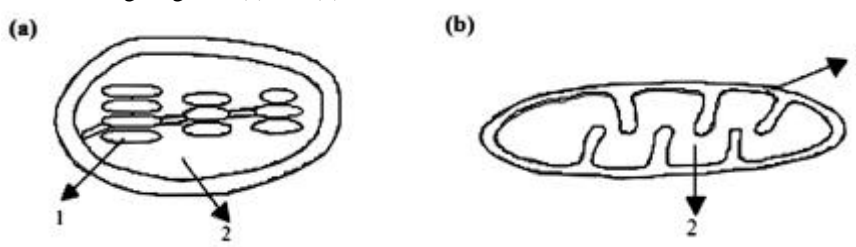




36. Refer the following diagram :



- (a) What kind of reflex is it?
 - (b) Where is it striking?
 - (c) List the errors in the above diagram?
37. (a) Nictitating membrane and Vermiform appendix are examples of which type of organs.
- (b) Define vestigial organs
- (c) Which of the following four can be categorised in the same category?
Out of coccyx, mammary glands muscles of external ear and opacity of eye due to cataract are these 4 in same categories.
38. Refer the following diagrams (a) and (b)



- Write the functions of (1) and (2) in each diagram.
39. In photorespiration, RuBP is oxidized to form glycolate and glycerate. Glycolate enters the PCO cycle to regenerate glycerate. Draw a flow diagram of photorespiration to show different intermediates and the cell organelles involved.

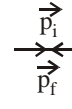
HINTS & SOLUTIONS

1. (a) Let n photons strike on the surface per second. Then the force exerted by the photons,

$$F = n (\Delta p)$$

Where $\Delta p =$ change in momentum per second

$$\Delta \vec{p} = \vec{p}_i - (-\vec{p}_f) = \vec{p}_i + \vec{p}_f$$



$$|\Delta \vec{p}| = 2p_i = 2 \times \frac{h}{\lambda} \quad (\because |\vec{p}_i| = |\vec{p}_f|)$$

$$\therefore F = n \times \frac{2h}{\lambda} \text{ or, } n = \frac{F\lambda}{2h}$$

Here, $F = 10 \text{ N}$, $\lambda = 439 \text{ nm} = 439 \times 10^{-9} \text{ m}$, $h = 6.625 \times 10^{-34} \text{ Js}$

$$\text{Putting all these values, we get } n = \frac{10 \times 439 \times 10^{-9}}{2 \times 6.625 \times 10^{-34}} = 3.313 \times 10^{27}.$$

- (b) Water can be boiled without supplying heat if it is kept inside a closed vessel and increasing the pressure on its surface such as water in a pressure cooker and also it can be boiled if pressure is reduced in a vessel containing water.

2. (a) Here, $A_1 = a$, $A_2 = a$ and $A = a$

We have,

$$A = A_1^2 + A_2^2 + 2A_1A_2 \cos(\phi_1 - \phi_2)$$

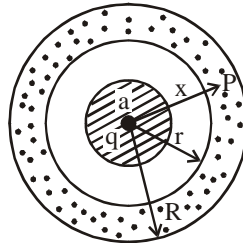
$$\text{or, } a^2 = a^2 + a^2 + 2a \cdot a \cos(\phi_1 - \phi_2)$$

$$\text{or, } a^2 = 2a^2 + 2a^2 \cos(\phi_1 - \phi_2)$$

$$\text{or, } a^2 = 2a^2 [1 + \cos(\phi_1 - \phi_2)]$$

$$\text{or, } \frac{1}{2} = 1 + \cos(\phi_1 - \phi_2) \text{ or, } \cos(\phi_1 - \phi_2) = -\frac{1}{2} \Rightarrow \phi_1 - \phi_2 = 120^\circ$$

- (b) Let the point at a distance x be P.



Then the potential at P is given by $V = V_1 + V_2 + V_3$

where, $V_1 =$ potential at P due to the solid sphere = $\frac{Kq}{x}$

$V_2 =$ potential at P due to the inner surface of the shell = $\frac{K(-q)}{x}$

$V_3 =$ potential at P due to the outer surface of the shell = $\frac{Kq}{R}$

$$\therefore V = \frac{Kq}{x} + \frac{K(-q)}{x} + \frac{Kq}{R} = \frac{Kq}{R}$$

3. (a) The ratio of specific heats, γ is given by

$\gamma = 1 + \frac{2}{n}$, where n is the degree of freedom. We know that the degree of freedom of a molecule is the number of independent ways in which it can have energy. Also, a monoatomic molecule can move linearly but can't rotate, so it can have energy along three directions viz. x , y and z axes only.
 \therefore For a monoatomic gas, $n = 3$.

Hence, $\gamma = 1 + \frac{2}{n} = 1 + \frac{2}{3}$ or, $\gamma = \frac{5}{3}$ (proved)

(b) From the figure the Boolean expression is $Y = \overline{\overline{A.B}}$

After simplification, we get

$Y = \overline{\overline{A} + \overline{B}}$ ($\because \overline{\overline{A.B}} = \overline{\overline{A} + \overline{B}}$ by absorptive law of Boolean algebra)
 $= A + B$

\therefore The truth table is as given below:

In puts		Out put
A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

4. (a) The differences between nuclear force and coulombic force are tabulated below:

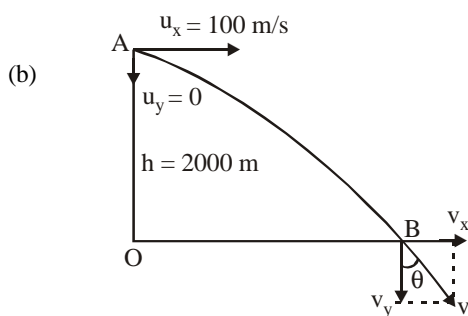
Nuclear Force

1. The force acting between the constituent particles of an atom is called nuclear force.
2. It is charge independent.
3. It is a short-range force.
4. It does not obey the inverse square law but it obeys inverse law of r^n where n is a very large number.
5. It is stronger than coulombic force

Coulombic Force

- The force acting between two charged particles is called coulombic force.
 It is charge dependent.
 It is a short as well as a long range force.
 It obeys the inverse square law of distance.

It is weaker than nuclear force.



Let θ be the required angle. Then $\tan \theta = \frac{v_x}{v_y}$

Where, $v_x =$ horizontal component of velocity when the object strikes the ground at B
 $= u_x + a_x t = u_x$ ($\because a_x = 0$)
 $= 100 \text{ m/s}$

$v_y =$ vertical component of velocity at B $= u_y + a_y t = gt$ ($\because u_y = 0, a_y = +g$)

$$\text{But } h = u_y t + \frac{1}{2} a_y t^2 = \frac{1}{2} g t^2 \Rightarrow t = \sqrt{\frac{2h}{g}}$$

$$\therefore v_y = g \times \sqrt{\frac{2h}{g}} = \sqrt{2gh} = \sqrt{2 \times 10 \times 2000} = 200 \text{ ms}^{-1}.$$

$$\therefore \tan \theta = \frac{v_x}{v_y} = \frac{100}{200} = \frac{1}{2}$$

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

(c) Clearly,

$$[\text{Angular momentum}] = [\text{ML}^2\text{T}^{-1}]$$

$$[\text{Impulse}] = [\text{MLT}^{-1}]$$

$$[\text{Energy}] = [\text{ML}^2\text{T}^{-2}]$$

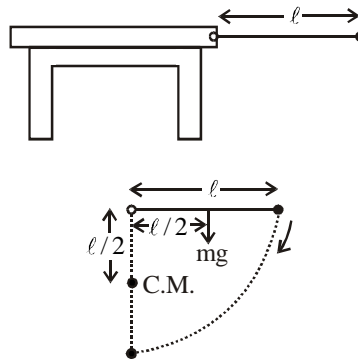
$$[\text{Torque}] = [\text{ML}^2\text{T}^{-2}]$$

$$[\text{Force}] = [\text{MLT}^{-2}]$$

$$[\text{Moment of Inertia}] = [\text{ML}^2]$$

Hence, the dimensional formulae of energy and torque are same.

5. (a) When the support is withdrawn, the rod will rotate about the axis passing through the hinged point.



$$\text{Torque acting on the rod about the axis of rotation} = mg\left(\frac{\ell}{2}\right)$$

$$\text{Also, Torque} = I\alpha, \text{ where } I = \text{moment of inertia of the rod about the axis of rotation} = \frac{m\ell^2}{3}$$

$$\text{If } a_{\text{cm}} \text{ be the acceleration of the centre of mass, then } \alpha = \frac{a_{\text{cm}}}{(\ell/2)}$$

$$\therefore mg\left(\frac{\ell}{2}\right) = I\alpha \text{ or, } \frac{mg\ell}{2} = \frac{m\ell^2}{3} \times \frac{a_{\text{cm}}}{\ell/2} \text{ or } \frac{mg\ell}{2} = \frac{2m\ell^2 \cdot a_{\text{cm}}}{3\ell}$$

$$\Rightarrow a_{\text{cm}} = \frac{3g\ell^2}{4m\ell^2} = \frac{3g}{4m} \text{ms}^{-2} = \frac{3 \times 10}{4m} \text{ms}^{-2} \quad \therefore a_{\text{cm}} = \frac{15}{2m} \text{ms}^{-2},$$

where m is the mass of the rod.

(b) We know that

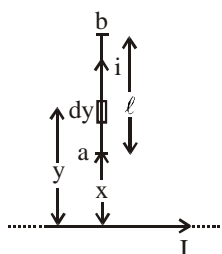
$n \propto \sqrt{T}$, where n = frequency and T = tension in the wire.

or, $n = KT^{1/2}$, where K is the constant of proportionality.

or, $\frac{\Delta T}{T} = 2\left(\frac{\Delta n}{n}\right)$, where ΔT is change in tension and Δn change in frequency.

or, % change in tension = $\frac{\Delta T}{T} \times 100 = 2\left(\frac{\Delta n}{n}\right) \times 100 = \frac{2 \times 5}{500} \times 100 = 2$

6. (a)



Let us consider a current element dy at a distance y from the wire carrying current I .
The magnetic field acting on the current element due to infinitely long conductor,

$$B = \frac{\mu_0 I}{2\pi y}$$

\therefore Force acting on dy length, $dF = idyB$

Now, total force acting on the conductor of length (ℓ),

$$F = \int_x^{(x+\ell)} idyB = \int_x^{(x+\ell)} \frac{\mu_0 I}{2\pi y} idy = \frac{\mu_0 Ii}{2\pi} = \int_x^{(x+\ell)} \left(\frac{1}{y}\right) dy = \frac{\mu_0 Ii}{2\pi} = [\ell \ln y]_x^{(x+\ell)}$$

$$= \frac{\mu_0 Ii}{2\pi} = [\ell \ln(x+\ell) - \ell \ln(x)] = \frac{\mu_0 Ii}{2\pi} = \left[\ell \ln \frac{(x+\ell)}{x} \right]$$

$$\text{or, } F = \frac{\mu_0 Ii}{2\pi} = \ell \ln \left(1 + \frac{\ell}{x} \right)$$

(b) We know that, Charge density $\sigma = \frac{q}{4\pi r^2}$ or, $q = (4\pi r^2) \cdot \sigma$.

Also, the potential on the surface of a conductor of any configuration is constant,

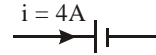
$$\text{i.e. } \frac{q}{4\pi\epsilon_0 r} = \text{constant or, } \frac{1}{4\pi\epsilon_0} \cdot \frac{(4\pi r^2) \cdot \sigma}{r} = \text{constant or, } r \cdot \sigma = \text{constant}$$

$$\text{or, } \sigma = \frac{\text{constant}}{r} \Rightarrow \sigma \propto \frac{1}{r}$$

Hence, the charge density varies inversely with distance but potential remains constant.

7. (a) **First case**

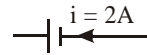
In this case, the battery is being charged.



$\therefore V = E + ir$, where E = emf of battery and r = internal resistance of the battery
 or, $12 = E + 4r$ (1)

Second case

In this case, the battery is being discharged.



$\therefore V = E - ir$ or, $9 = E - 2r$ (2)
 Subtracting (2) from (1), we get

$$3 = 6r \Rightarrow r = \frac{3}{6} = \frac{1}{2} = 0.5\Omega$$

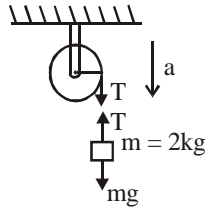
Putting this value of r in (1), we get $12 = E + (0.5 \times 4)$ or, $E = 10\text{ V}$

$\therefore E = 10\text{V}$ and $r = 0.5\Omega$.

(b) Considering the rotational motion of the pulley,

we get $T \cdot r = I\alpha$ or, $T \cdot r = I \left(\frac{a}{r} \right)$

Where, a is the linear acceleration of the pulley in downward direction.



$$\therefore T = \frac{Ia}{r^2} \text{ (1)}$$

Now, considering the motion of the mass $m (= 2\text{kg})$, we get $mg - T = ma$

or, $mg - \frac{Ia}{r^2} = ma$; from (1)

or, $ma + \frac{Ia}{r^2} = mg$ or, $a \left(m + \frac{I}{r^2} \right) = mg \Rightarrow a = \frac{mg}{\left(m + \frac{I}{r^2} \right)}$

Putting the values of m, g, I and r , we get

$$a = \frac{2 \times 10}{\left[2 + \frac{0.32}{(0.2)^2} \right]} = \frac{20}{2+8} \text{ms}^{-2} = \frac{20}{10} \text{ms}^{-2} \therefore 2 \text{ms}^{-2}$$

8. (a) Energy of capacitor, $E_C = \frac{1}{2} \times CV^2 = \frac{1}{2} \times (6 \times 10^{-6}) \times (6)^2 = 108 \times 10^{-6} \text{ J}$

When the capacitor is connected to the inductor, the magnetic energy, $E_B = \frac{1}{2} Li^2$

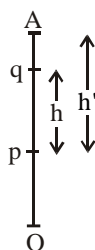
or, $E_B = \frac{1}{2} \times (5 \times 10^{-3}) \times i^2 = (2.5 \times 10^{-3}) i^2$

According to question, $E_B = \frac{1}{2} \times E_C$ or, $(2.5 \times 10^{-3})^2 = \frac{1}{3} \times 108 \times 10^{-6}$

$$\text{or, } i^2 = \frac{108 \times 10^{-6}}{3 \times 2.5 \times 10^{-3}} = \frac{43.2 \times 10^{-3}}{3} = 14.40 \times 10^{-3} = 144 \times 10^{-4}$$

$$\therefore i = \sqrt{144 \times 10^{-4}} \text{ A or, } i = 12 \times 10^{-2} \text{ A.}$$

- (b) Let A be the highest point and h' the distance between the point p and A. Here, t_p = time taken in going from p to A and again from A to p



$$\therefore \text{ time taken in coming from A to p} = \frac{t_p}{2}.$$

$$\text{Similarly, time taken in falling from A to q} = \frac{t_q}{2}.$$

$$\text{Now, } h' = \frac{1}{2}g\left(\frac{t_p}{2}\right)^2 = \frac{gt_p^2}{8} \quad \dots(i)$$

$$\text{and } h' - h = \frac{1}{2}g\left(\frac{t_q}{2}\right)^2 = \frac{gt_q^2}{8} \quad \dots(ii)$$

$$\text{Subtracting (ii) from (i), we get } h = \frac{gt_p^2}{8} - \frac{gt_q^2}{8} = \frac{g}{8}(t_p^2 - t_q^2) \text{ or, } g = \frac{8h}{t_p^2 - t_q^2}$$

which is the required relation.

9. (a) For the coil n, we have $15 \times \phi_n = MI_m$ or, $15 \times 1.8 \times 10^{-4} = M \times 2$

$$\therefore M = 13.5 \times 10^{-4} \text{ H}$$

$$\text{For the coil m, we have } 10 \times \phi_m = MI_n \text{ or, } \phi_m = \frac{MI_n}{10} = \frac{13.5 \times 10^{-4} \times 3}{10} = 40.5 \times 10^{-5} \text{ Wb.}$$

- (b) We know that the velocity of transverse wave in a string of mass per unit length μ and tension T is given by

$$v = \sqrt{\frac{T}{\mu}} = \sqrt{\frac{360}{4 \times 10^{-3}}} = 3 \times 10^2 \text{ m/s} = 300 \text{ m/s}$$

\therefore The string produces two consecutive resonant frequencies 375 Hz and 450 Hz with a tuning fork.

$$\text{We have } n \frac{v}{2\ell} = 375 \quad \dots(i)$$

$$\text{and } (n+1) \frac{v}{2\ell} = 450 \quad \dots(ii)$$

where n is an integer

$$\text{Subtracting (i) from (ii), we get } (n+1-n) \cdot \frac{v}{2\ell} = 75 \quad \text{or, } \frac{v}{2\ell} = 75 \quad \text{or, } \frac{300}{2\ell} = 75$$

$$\Rightarrow \ell = 2 \quad \therefore \text{Mass per unit length } (\mu) = 4 \times 10^{-3}$$

$$\text{or, } \frac{m}{\ell} = 4 \times 10^{-3} \quad \text{or, } m = 4 \times 10^{-3} \times \ell = 4 \times 10^{-3} \times 2$$

$$\therefore m = 8 \times 10^{-3} \text{ kg.}$$

10. (a) Here, wavelength (λ) of photon = $3300 \text{ \AA} = 3300 \times 10^{-10} = 3.3 \times 10^{-7} \text{ m.}$

$$\text{work function } (\phi) \text{ of the surface} = 2.5 \text{ eV} = 2.5 \times 1.6 \times 10^{-19} \text{ J} = 4.0 \times 10^{-19} \text{ J}$$

$$\text{Energy of incident photon} = \frac{hc}{\lambda} = \frac{6.625 \times 10^{-34} \times 3 \times 10^8}{3.3 \times 10^{-7}} \text{ J} = 6.02 \times 10^{-19} \text{ J}$$

By Einstein's equation of photoelectric effect, we have $E = \phi + T_{\max}$

$$\text{or, } T_{\max} = E - \phi = 6.02 \times 10^{-19} - 4.0 \times 10^{-19} \text{ J} = 2.02 \times 10^{-19} \text{ J}$$

Now, as the emitted electrons enter a magnetic field and turn in a circular path, the radius of the path is given by

$$R = \frac{\sqrt{2m(T_{\max})}}{qB} \Rightarrow q = \frac{\sqrt{2m(T_{\max})}}{RB}$$

Putting the values of m , R , B and T_{\max} , we get

$$q = \frac{\sqrt{2 \times 9.1 \times 10^{-31} \times 2.02 \times 10^{-19}}}{50 \times 10^{-2} \times 6.7 \times 10^{-6}} \text{ coulomb} = \frac{6.04 \times 10^{-25}}{3.35 \times 10^{-6}} \text{ coulomb} = 1.8 \times 10^{-19} \text{ C (approx.)}$$

- (b) We have, from Curie's law, $I \propto \frac{B}{T}$

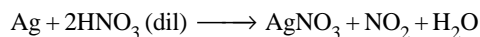
where, I = intensity of magnetization, B = magnetic field, T = absolute temperature

when B and T are tripled, the new intensity of magnetization, $I' \propto \frac{3B}{3T} \propto \frac{B}{T}$

So, intensity of magnetization will not change.

Chemistry

11. (i) Less reactive metals like Ag oxidise more readily in HNO_3 than HCl because HNO_3 behaves as an oxidising acid while HCl as non-oxidising acid.



Further if we calculate E_{cell}° for the reaction. we get

$$E_{\text{cell}}^\circ = E_{\text{cathode}}^\circ - E_{\text{anode}}^\circ = +0.96 - (-0.79) = +1.75 \text{ volt.}$$

From the relation $\Delta G = -nFE^\circ$, we found ΔG to be negative.

Since the E_{cell}° is +ve, thus the reaction would be spontaneous under standard condition.

$$(\Delta G = -nFE)$$

$$(ii) \text{ Given } \alpha = \frac{1.2}{100} = 0.012 \text{ and } C = 0.1 \text{ M}$$

12. (i) Intermolecular hydrogen bonding is found in NH_3 which increases its solubility whereas as hydrogen bonding does not found in PH_3 which make it less soluble.
- (ii) BF_3 is a monomeric covalent species. They do not dimerize like BH_3 because the lone pairs on the halogens can interact with the vacant p orbital on boron due to which the electron deficiency of the central boron is satisfied whereas this property is not seen in BH_3 .
- (iii) The carbon atoms are approximately equidistant from the platinum atom and the distance from the midpoint of the C – C bond to the platinum atom is 2.022 Å. The C – C distance, 1.375 (4) Å, is 0.038 Å longer than the value found in free ethylene, indicating some $d\pi - p\pi^*$ back-bonding from the platinum atom to C_2H_4 . Back-bonding is also indicated by a bending of the four hydrogen atoms away from the platinum atom. The carbon atoms are at an average distance of 0.164 Å from the plane of the four hydrogen atoms, and the angle between the normals to the methylene planes (the α angle) is 32.5° . Both the magnitude of α and the C – C bond lengthening are considerably smaller in Zeise's salt.
13. (i) For H-like particles energy of electron in nth shell.

$$E_n = -\frac{1312Z^2}{n^2} \text{ kJ mol}^{-1}$$

$$\therefore \text{Energy in IIInd orbit of hydrogen} = -\frac{1312 \times 1^2}{2^2} \text{ kJ mol}^{-1} = -\frac{1312}{4} \text{ kJ mol}^{-1}$$

$$\text{and for Li}^{++}, E_n = -\frac{1312 \times 3^2}{6^2} = -\frac{1312}{4} \text{ kJ mol}^{-1}$$

Therefore if the electron is in sixth orbit of Li^{++} , energy would be same.

- (ii) As the rate law expression does not involve the concentration of I_2 therefore order of reaction w.r.t I_2 is 0.
As given in the expression that $\text{Rate} = k[\text{CH}_3\text{COCH}_3][\text{H}^+]$
Now substitute the values in the expression.
 $2 \times 10^{-2} = k[2.5 \times 10^{-2}][1.5 \times 10^{-3}]$

$$\therefore k = \frac{2 \times 10^{-2} \text{ mol lit}^{-1}}{2.5 \times 10^{-2} \times 1.5 \times 10^{-3} \text{ mol}^2 \text{ lit}^{-2}} = 0.535 \times 10^{-3} = 5.33 \times 10^{-4} \text{ mol}^{-2} \text{ lit sec}^{-1}$$

$$(iii) \text{ Given } v = 3.3 \times 10^{15} \left(\frac{1}{2^2} - \frac{1}{n^2} \right)$$

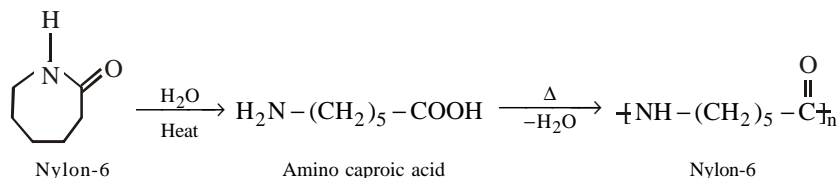
$$\lambda = 6600 \text{ \AA} = 6600 \times 10^{-10} \text{ meter and } v = \frac{c}{\lambda}$$

$$\therefore \frac{c}{\lambda} = 3.3 \times 10^{15} \left(\frac{1}{2^2} - \frac{1}{n^2} \right) \Rightarrow \frac{3 \times 10^8}{6.6 \times 10^{-7}} = 3.3 \times 10^{15} \left(\frac{1}{4} - \frac{1}{n^2} \right) \Rightarrow 0.138 = \frac{1}{4} - \frac{1}{n^2}$$

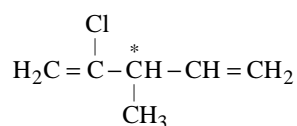
$$\Rightarrow \frac{1}{n^2} = \frac{1}{4} - \frac{138}{1000} = \frac{1000 - 552}{4000} = \frac{448}{4000}$$

$$\Rightarrow n^2 = \frac{4000}{448} \Rightarrow n = \frac{63.24}{21.16} = 2.988 \approx 3$$

14. (i) Caprolactam on heating with traces of water gives ϵ -amino caproic acid which is mono-carboxylic amino acid containing six carbon atoms. This polymerises to give nylon-6.

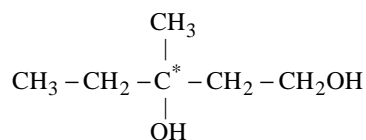


- (ii) (a) 2-chloro 3 methyl pent-1, 4 diene is optically active as it contains chiral carbon atom.

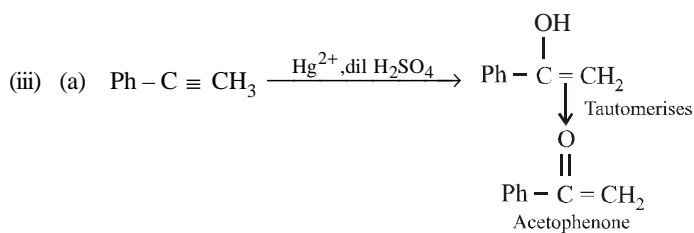
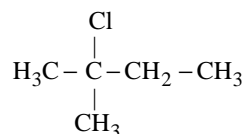


Note : - A Chiral carbon atom is attached to four different atoms or groups.

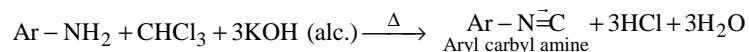
- (b) This compound is also optically active due to the presence of chiral carbon atom.



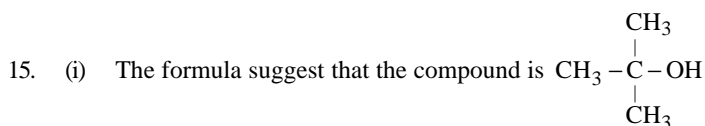
- (c) This compound is not optically active as it does not any chiral carbon atom.



- (b) **Carbylamine reaction** : - When a primary amine reacts with chloroform and alcoholic KOH give isocyanides or carbylamines which have unpleasant smell.

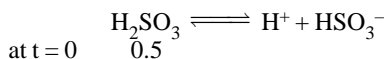
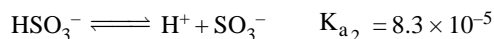


- (iv) As the given alkene is a symmetrical alkene thus, addition of HBr to it does not follow Markovnikoff's rule hence the product formed would be same in both cases i.e. in presence of peroxide and in absence of peroxide.



i.e. a tertiary alcohol therefore alkane from which it is formed must be

17. (i) Given, $\text{H}_2\text{SO}_3 \rightleftharpoons \text{H}^+ + \text{HSO}_3^-$ $K_{a_1} = 1.8 \times 10^{-2}$



at $t = 0$

at t_{eq} $0.5 - \alpha$ α α

where α = degree of dissociation

$$\text{Now } K_{a_1} = \frac{[\text{H}^+][\text{HSO}_3^-]}{[\text{H}_2\text{SO}_3]}$$

$$\therefore K_{a_1} = \frac{\alpha^2}{(0.5 - \alpha)} = 1.8 \times 10^{-2} \text{ or } \alpha^2 = 0.9 \times 10^{-2} - 1.8 \times 10^{-2} \alpha \text{ or } \alpha^2 + 1.8 \times 10^{-2} \alpha - 0.9 \times 10^{-2} = 0$$

On solving the value of α , we get $\alpha = 0.08625$ mol/l

$$\therefore [\text{H}^+] = [\text{HSO}_3^-] = 0.08625 \text{ mol/l and } K_{a_2} = \frac{[\text{SO}_3^{2-}][\text{H}^+]}{[\text{HSO}_3^-]}$$

now substitute of the value of $[\text{H}^+]$ and $[\text{HSO}_3^-]$

$$\text{in above equation, we get } 8.3 \times 10^{-5} = \frac{[\text{SO}_3^{2-}][0.08625]}{[0.08625]}$$

$$[\text{SO}_3^{2-}] = 8.3 \times 10^{-5} \text{ mol/l}$$

- (ii) $\text{N}_2\text{O}_4 \rightleftharpoons 2 \text{NO}_2$
- | | | | |
|-----------------|---------------|----------------------|--|
| $t = 0$ | $\frac{1}{1}$ | $\frac{0}{0}$ | |
| t_{eq} | $1 - 0.4$ | $0.4 \times 2 = 0.8$ | |
- Total no of moles = $1 - 0.4 + 0.8 = 1.4$

$$\text{Now } K_x = \frac{[x_{\text{NO}_2}]}{[x_{\text{N}_2\text{O}_4}]} \quad \text{where } x_{\text{NO}_2} = \frac{0.8}{1.4} \text{ and } x_{\text{N}_2\text{O}_4} = \frac{0.6}{1.4}$$

$$\therefore K_x = \left(\frac{0.8}{1.4} \right)^2 \bigg/ \frac{0.6}{1.4} = 0.76$$

$$\text{As } K_p = K_x (P_{\text{total}})^{\Delta n_g} = 0.76 \times (1) = 0.76 \text{ atm} \quad \therefore (\Delta n_g = 2 - 1 = 1)$$

- (iii) $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$
- | | | |
|------------------|-----------------|------------------|
| 1 mole | 3-mole | 2 mole |
|------------------|-----------------|------------------|

i.e. 1 mole of N_2 react with 3 mole of H_2 to form 2 mole of NH_3 , but the amount of H_2 taken is 4 moles thus the H_2 will be the residual gas and hence

$$P_{\text{H}_2} \times V = nRT$$

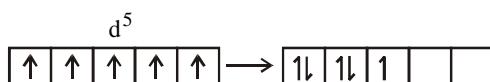
$$P_{\text{H}_2} \times 10 = 1 \times 0.0821 \times 298$$

$$P_{\text{H}_2} = 2.45 \text{ atm.}$$

Now the effective volume of the vessel occupied by H_2 gas is $20 - 10 = 10$ litre

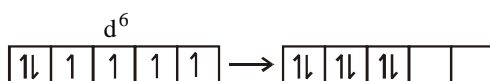
18. (i) F_2 is more reactive than Cl_2 because bond dissociation energy of Cl_2 is more than F_2 , because of interionic repulsions present in the small atom of fluorine.

- (ii) The most stable oxidation state of Cr is +3 and +6, whereas the stable oxidation states of Mo are +3, +4, +5 and +6, Chromium will try to pass from +6, O No to +3 oxidation state when it form Cr^{+++} from CrO_4^- thus it is less stable and hence more oxidizing. Whereas Mo is much more stable and hence is less oxidizing.
- (iii) In $(\text{SiH}_3)_2\text{O}$, the Si – O bond show $\text{P}\pi - \text{d}\pi$ bonding due to which $\text{p}\pi$ electrons of O are loosely bound and ease of these electrons are much easier and hence is more basic. Whereas in $(\text{CH}_3)_2\text{O} - \text{P}\pi - \text{d}\pi$ bonding is not possible and therefore, the availability of $\text{p}\pi$ electrons is very less, hence is less basic.
19. (i) As on churning the compound with AgNO_3 we get $\text{Pt}(\text{NH}_3)_4 \text{Cl}_2$ and $\text{Ag}_2 [\text{PtCl}_4]$. Thus we can expect that the complex must be a higher derivative of the compound given i.e. $\text{PtCl}_2 \cdot (\text{NH}_3)_2$. Thus the molecular formula of the compound would be
- $$[\text{Pt}(\text{NH}_3)_4]^{2+} \quad [\text{PtCl}_4]^{2-}$$
- tetra ammineplatinum (II) tetrachloro platinum (II)
- (ii) As N is more electronegative than P therefore the electronegativity difference between C & N in $(\text{CH}_3)_3\text{N}$ is more than the electronegativity difference between C & P in $(\text{C}_2\text{H}_5)_3\text{P}$ thus the dipole moment of $(\text{CH}_3)_3\text{N}$ is higher than $(\text{C}_2\text{H}_5)_3\text{P}$. Further, both the molecules are pyramidal due to the repulsion arises between the ethyl groups in $(\text{C}_2\text{H}_5)_3\text{P}$ the bond angle is larger and hence lower is the dipole moment.
20. (i) $\text{P}(15) = 1s^2 2s^2 2p^6 3s^2 3p^3 3d^0$, $\text{N}(7) = 1s^2 2s^2 2p^3$
As P contains vacant d orbit, thus it can exceed its octet and utilize d-orbitals for multiple bonding. whereas N can not exceed its octet due to the absence of d-orbital and hence can not form NO_4^{3-} ion.
- (ii) The Molecular orbital configuration of B_2 is $\text{B}_2 - \text{KK } \sigma(2s)^2 \sigma^*(2s)^2 \pi(2p_x)^1 \pi(2p_y)^1$
As it contains two unpaired e^- therefore it is paramagnetic and the molecular orbital configuration of C_2 is $\text{C}_2 = \text{KK } \sigma(2s)^2 \sigma^*(2s)^2 \pi(2p_x)^2 \pi(2p_y)^2$
As it does not contains any unpaired e^- thus this is diamagnetic.
- (iii) When $\Delta_o < P$ i.e. when the pairing energy is higher, then



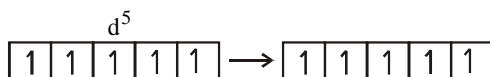
No. of unpaired electron remain = 1 (Paramagnetic)

$$\therefore \text{Spin magnetic moment } \mu = \sqrt{n(n+2)} = \sqrt{1(1+2)} = \sqrt{3} = 1.732 \text{ B.M.}$$

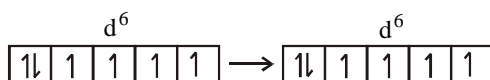


No. of unpaired $e^- = 0$ (Diamagnetic)

$\therefore \mu = 0$ when $\Delta_o > P$ i.e. when the pairing energy is less than



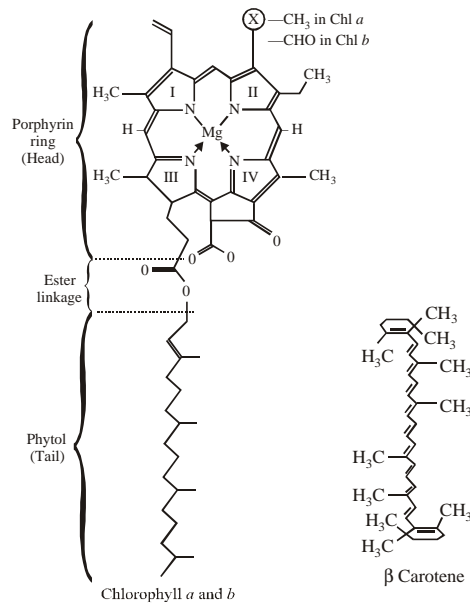
No. of unpaired $e^- = 5$, $\mu = \sqrt{5(5+2)} = \sqrt{35} = 5.91 \text{ B.M.}$



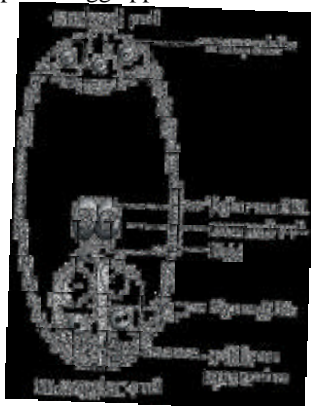
No. of unpaired $e^- = 4$, $\mu = \sqrt{4(4+2)} = \sqrt{24} = 4.89 \text{ B.M.}$

Biology

21. (a) **Cytoskeleton** : They are extremely minute, fibrous and tubular structures which form the structural frame work inside the cell. Cytoskeletal structures occur only in eukaryotic cells. They were discovered with the help of fluorescence microscopy. Cytoskeletal structures maintain shape of the cell and its extensions, regulate orientation and distribution of cell organelles, intra cellular transport and movement of cells. They are of three types – microfilaments, intermediate filaments and microtubules.
- (b) **Phyalol chain** - phytol chain tail in association with porphyrin (ring head) through ester linkage forms a chlorophyll molecule.



- (c) **Synergids** - synergids are the part of egg apparatus which is located inside the imbyro sac.



- (d) **Sieve tube elements**: Sieve tubes are elongated tubular conducting channels of phloem. Each sieve tube is formed of several cells called sieve tube elements or members, sieve tube cells or sieve elements. Sieve tube members are placed end to end. The endwalls are generally bulged out. They may be transverse or oblique. They have many small pores or sieve pits. Each sieve pore is lined by a layer of callose. Its function is translocation of solute.

- (e) **Centromere** - The two chromatids of chromosomes are attached to each other by a narrow area which is also known as primary constriction. It is the site at which the spindle attaches during cell division which is also concerned with anaphasic movement of chromosome. On the basis of position of centromere chromosome shape is also determined like telocentric acrocentric, submetacentric, metacentric.
22. (a) Nostoc which is a filamentous blue - green alga. The region marked as (P), in the figure is Heterocyst which is large - sized, pale coloured thick-walled cell which occurs in terminal intercalary or lateral position. It is specialised to perform nitrogen fixation. The region marked (Q) is Akinete which helps in asexual reproduction.
- (b) It is T_2 -phase of bacteriophage which comes under T-even phage and is also known as coliphage. The region marked as (a) in the figure is collar and the region marked as (b) is tail fibre.
- (c) This ovule is anatropous because the ovule is inverted at 180° angle which is also called resupination. In this case, micropyle and funicle are closer.
- (d) Epigynous flower (inferior ovary) - The thalamus grows further upwards thus enclosing the ovary and finally fusing with it.
- (e) This is vexillary aestivation which is seen in the whorl of five petals where the posterior one is the largest and almost covers the two lateral petals and the latter in turn nearly overlap two anterior petals, e.g., papilionaceae soybean, gram, etc.
23. (a) Pea - In this case, placenta develops along the junction of the two margins of the carpels in one-chambered ovary which is known as marginal placentation. Inflorescence may be solitary axillary or terminal, raceme. Fruit type is pod or legume, where fruit is formed from superior unilocular ovary of a monocarpellary pistil.
- (b) Coriander - In this case, the ovary is multi-chambered and placenta bearing ovules develop from the central axis which is known as axile.
Inflorescence is compound umbel because peduncle or main axis gives branches repeatedly once or twice in umbel or racemose manner. And fruit is of cremocarp type where fruit develops from anterior, bilocular ovary of a bicarpellary syncarpous pistil with persistent stylopod or stylopodium.
- (c) Wheat - Since the ovary is unilocular and placenta develops directly on the thalamus and bears a single ovule at the base of the ovary. So, the placentation is of basal type. The inflorescence is spikelet which bears two empty glumes (bracts) and also bears IIIrd bract (flowering glumes) or lemma or lower palea. The fruit is of caryopsis type.
- (d) Sunflower - In this case, placentation is again of basal type because the ovary is unilocular and placenta develops directly on the thalamus and bears single ovule at the base of ovary.
The inflorescence is capitulum or head because its receptacle is flattened, bears sessile flowers and florets in a centripetal manner.
Fruit type is of cypsela - in this case fruit develops from a monocarpellary pistil with superior, unilocular and uniovuled ovary.
- (e) Mustard : Parietal placentation is present in mustard where ovary is one-chambered and placenta bears the ovules which develop on the inner - wall of the ovary and their position corresponds to the confluent margins of the carpels and the number of placenta is equal to the number of carpel. The fruit is of siliqua type.
24. (a) **Culm** : The stem or stalk of a grass or sedge. Usually has a seed head at the top.
The erect stem of a grass. The stem with solid nodes and hollow internodes is called culm. e.g., Bambusa is branched cylindrical,
Caudex : The caudex is an enlarged, woody base of the stem or trunk (located just below the ground) on some plants - it is used for water storage. Many desert plants have a caudex, an adaptation to dry conditions. Some palms, cycads, and succulents have a caudex. e.g., Date palm.
- (b) **Slime molds** : They are vegetative cells without cell wall while spores are with cellulosic cell wall. Protists that may represent a transition between protists and fungi are called slime molds.

Phylum of fungus like 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. About 500 species have been described. Also, myxomycetes, mycetozoa.

Fungi : They are vegetative cell with cell wall which is made up of either fungal cellulose chitin or both. Saprophytic and parasitic organisms that lack chlorophyll and include molds, rusts, mildews, smuts, mushrooms and yeast; singular, fungus.

They are aerobic, multicellular, nonphotosynthetic, heterotrophic microorganisms. The fungi include mushrooms, yeast, molds, and smuts. Fungi have two ecological advantages over bacteria: (1) they can grow in low moisture areas, and (2) they can grow in low pH environments.

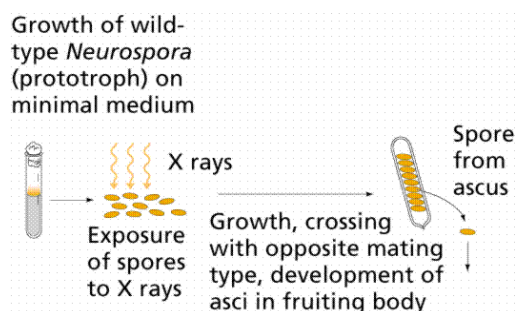
- (d) **Biological Magnification :** Refers to the process whereby certain substances such as pesticides or heavy metals move up the food chain, work their way into rivers or lakes, and are eaten by aquatic organisms such as fish, which in turn are eaten by large birds, animals or humans. The substances become concentrated in tissues or internal organs as they move up the chain.

Eutrophication : Over-enrichment of a water body with nutrients, resulting in excessive growth of organisms and depletion of oxygen concentration. The process by which a body of water becomes either naturally or by pollution rich in dissolved nutrients (as phosphates) and often shallow with a seasonal deficiency in dissolved oxygen.e.g., Disease of crucifers caused by Albuginaceae (Peronosporales: Oomycota). Zinc oxide; the powdery product of corrosion of zinc or zinc-coated surfaces. Fungus causing a disease characterized by a white powdery mass of conidia.

- (e) **White rust :** It is a fungal disease caused by *Cystopus candidus* or *Albugo candida* on vegetative parts of crucifers.

Brown rust : It is a fungal disease caused by *Puccinia recondita* on vegetative parts of wheat plant.

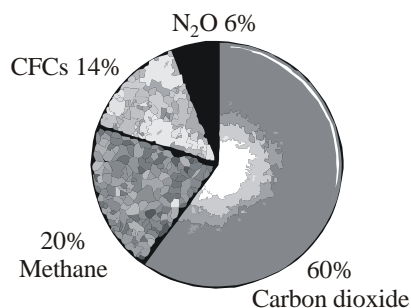
25. (a) Jacob and monod gave the 'operon' model to explain the regulation of gene expression in the bacterium E. Coli in 1961.
- (b) Beadle and Tatum proposed the "one gene one enzyme" theory. One gene codes for the production of one protein. "One gene one enzyme" has since been modified to "one gene one polypeptide" since many proteins (such as hemoglobin) are made of more than one polypeptide.



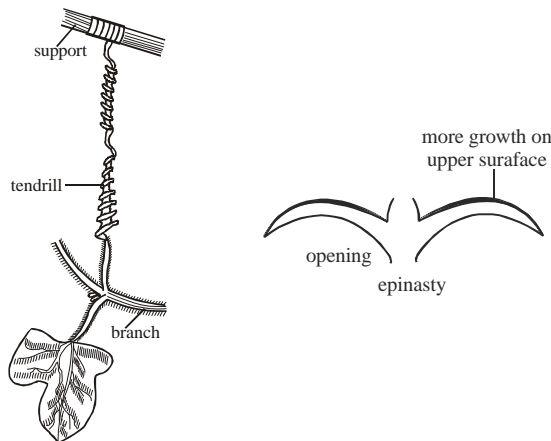
- (c) An Okazaki fragment is a relatively short fragment of DNA (with an RNA primer at the 5' terminus) created on the lagging strand during DNA replication. These fragments are processed by the replication machinery to produce a continuous strand of DNA and hence a complete daughter DNA helix. It was given by Griffith.
- (d) Reverse transcriptase is the replication enzyme of retroviruses which was discovered by Temin and Baltimore.
26. (a) **Pneumatophores :** Vivipary pneumatophore - an air-filled root (submerged or exposed) that can function as a respiratory organ of a marsh or swamp plant
- Vivipary :** A phenomenon that occurs when the embryo breaks through the seed coat (and defies natural growth inhibitors, such as are present in tomato and other fruit seeds) to begin growing, sometimes while the fruit is still attached to the parent plant.

- (b) Marsilea; Eichhornia
Marsilea which is a water clover: water fern of Europe and Asia and the eastern United States distinguished by four leaflets resembling clover leaves
Eichhornia : Eichhornia Azorea is one of those plants used frequently in the so called 'Dutch aquariums'. It is a very unusual plant with long bright green leaves spreading widely sideways, which makes it look very flat. It loves bright lighting, CO₂ and rich bottom.
- (c) Monoecious, Geitonogamy
 Monoecious term is used to denote bisexual condition means presence of both reproductive organs in the same organism. Geitonogamy is the transfer of pollen grains from the another to the stigma of another flower of the same plant. Although geitonogamy is functionally cross-pollination involving a pollinating agent, genetically it is similar to autogamy since the pollen grains come from the same plant.
- (d) Cycas and coralloid root (which has the form of coral; branching like coral)
27. (a) Heterospory (which is a condition in which an organism produces two different types and sizes of spores, viz. microspores and megaspores) and formation of female gametophyte inside megasporangium.
 (b) Selaginella : The advent of reproduction by seeds was one of the most essential evolutionary steps in plant history: the vast majority of living plants are seed plants (spermatophytes). The seed habit includes the following set of defining characteristics: (1) heterospory, (2) occurrence of a single megaspore that germinates within an indehiscent megasporangium (nucellus) retained on the sporophyte, (3) enclosure of the megasporangium in an integument, and (4) capture of pollen before seed dispersal. Contrasting hypotheses about the single / multiple, saltational / gradual origin of the seed habit. Pteris and Dryopteris possess the seed habit.
 (c) Mechanical Scarification, Stratification, Impaction.
 Seeds of almost all plants growing in areas with marked seasonal temperature variations require a period of cold treatment prior to germination, just as buds do. This requirement is usually satisfied by our winter temperatures. There are several ways to break the dormancy of seeds. For example, for some species, if moist seed is exposed to a low temperature for many days, dormancy may be broken and the seed germinated. The average temperature and time are 5°C for 100 days). This horticultural procedure is called STRATIFICATION.
 Dormancy may be caused by the embryo being immature or though mature, germination will not occur because of the external seed coat or dormancy may be controlled by the internal physiology of the seed or a combination of internal and external dormancies may be responsible.
 Mechanical abrasion or breaking the seed coat, which is termed SCARIFICATION with a knife, file or sandpaper may allow the hard seed condition or inhibitor to be removed or metabolic activity requisite to germination to be initiated. Impaction or the third condition is to keep the seed under certain condition which breaks the seed dormancy.
28. (a) Sudden or inheritable – It arises due to change in base pair of the genetic materials.
 (b) New Alleles – It is the term used by Mendel to define genes which is also known as factor. It is the particular form of gene.
 (c) Recessive – If the gene is in homozygous state then both alleles are expressed, If it is in heterozygous then one is expressed (dominant)
 (d) Codominance – Both genes of allelo morphic pair express themselves equally in F₁ - hybrids.
 (e) Wild type gene : Wild type, sometimes written wild type or wild-type, is the typical form of an organism, strain, gene, or characteristic as it occurs in nature. Wild type refers to the most common phenotype in the natural population. The phenotype can be dominant or recessive.
 In biology it relates specifically to the difference between a naturally occurring organism and one that has been deliberately mutated.
 Mutant is an antonym of wild type.

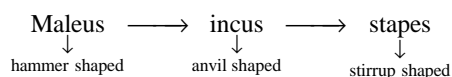
29. (a) Photoperiodism. was first studied by Garner and Allard in 1920.
 (b) SDP (short day plants) or long night plants-Chrysanthemum LDP (long day plants - spinach
 (c) Borthwick and Hendricks in 1952 reported phytochrome pigment. Induction of flowering.
30. (a) Indian Rhinoceros are now in the list of endangered species because its populations have decreased or habits have been reduced to the levels that pose immediate danger of extinction.
 (b) Acid rain refers to precipitation with a pH of less than 5. It is, in fact, a mixture of H_2SO_4 and HNO_3 .
 (c) Somaclonal variations is a type of mutation which is spontaneous in origin. The variations observed among plants regenerated from tissue culture is termed as somaclonal variation.
 (d) protoplasm fusion – PEG
 (e) Biopiracy – turmeric
31. (a) Habitat and Niche: Habitat means to dwell. It is a specific place where a species or population normally lives in nature, which is a physical area, some particular part of earth's surface, air, soil or water. It includes both living and non-living objects.
 Niche - The word niche literally means a specific place. How-ever, The ecologists use it for the habitat along with the role a species or population plays in its ecosystem. In other words, niche means the total interaction of a species with its environment or its functional position or status in an ecosystem. Xerophytic vegetation is found in desert.
 (b) **Flora** : All species of plants that are found in a particular region, period, or special environment. Six floral kingdoms are commonly distinguished: Boreal (Holarctic), Paleotropical, Neotropical, South African (Capensic), Australian, and Antarctic. These kingdoms are further broken down into subkingdoms and regions, over which there is some dispute.
Vegetation : Types of plant species found in an area constitute the vegetation of the area. It is also the process of growth in plants. An abnormal growth or excrescence (especially a warty excrescence on the valves of the heart) is also known as vegetation.
32. (a) $CFC_s = 14\%$, $CH_4 = 20\%$, $N_2O = 6\%$ and the rest 60% are CO_2



- (b) Type of movement of twiner is thigmotropic movement e.g cucurbit plant .



33. (a) According to the given conditions and graph a shows complete growth, b shows retarded growth and c shows moderate growth.
 (b) Vitamin i.e Retinol
 (c) Hyper-concentration of retinol leads to hypervitaminosis A which is characterised by anorexia, headach, irritabilily, hepatosplenomegaly, dermatitis, bone pain, loss of hair in patch etc. Overdoses of phyridoxine can cause peripheral neuropathy. Overdose of ascorbie acid is less likely to cause any problem because it can be rapidly cleared from the body.
34. (a) Earthworm is different from rest of animals because earthworm is monoecious (or) hermaphrodite while rest are dioecious.
 (b) Scorpion and Honey bee carry poison to defend themselves from the enemy. Scorpion belongs to class - Arachnida of phylum - Arthropoda. Honey bee belongs class insecta of phylum - Arthropoda.
 (c) Bat and whale belong to class Mammalia . The bats are the only mammals which have wings and can really fly. Whale is the largest animal in existence and is the unhabitants of the open ocean, strandings and offshore sightings are rare.
 (d) Earthworm which is also known as pheretima is the representative of phylum - Annelida. Starfish is found in rocky area floor which is carnivorous, which possess greater power of regeneration and shows autotomy represents the phylum echinodermata.
 (e) Bat and whales which are the members of class mammalia, like human have 3 ear oscicles in the order



3 ear ascicles are the characteristics of mammalia.

35. (a) In the graph (A) population remains stable that means it will be statronary phase or plateaus phase. While in the graph (B) it will the lag phase or exponential phase when the population will increase tremendously.
 (b) Graph (A) shows the stable growth so the resources available will be more like getting jobs ultimately more professional job opportunity will be in the developed nation which will force to migrate the population from developing nation to the developed nation.

36.

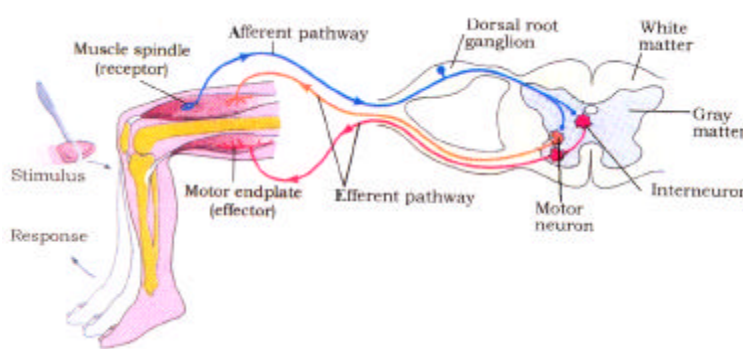


Diagram: Diagrammatic presentation of reflex action (showing knee jerk reflex)

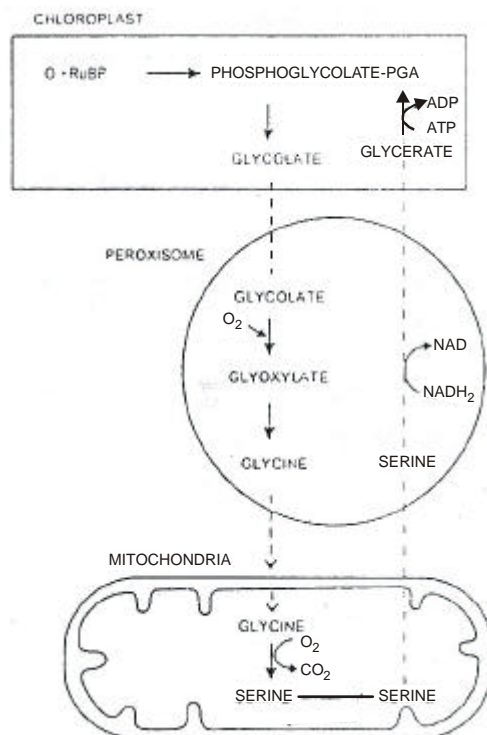
- (a) It is knee jerk reflex.
 (b) In case of knee jerk reflex tendon of patella is tapped.
 (c) Gray matter is replaced by white matter. Efferent pathway should be afferent pathway and afferent pathway should be efferent pathway because afferent end transmits the impulse via a dorsal nerve root in the CNS (at the level of spinal cord) and the efferent neuron then carries signals from CNS to the effector.

37. (a) These two are the examples of vestigial organs which were functional in ancestors but functionless in modern humans.
- (b) The organs which occur in reduced form and are useless to the possessor, but are homologous to the fully developed, functional organs of related animals are called vestigial organs. The existence of vestigial or useless organs is satisfactorily explained by the doctrine of organic evolution. These organs were fully developed, functional and necessary in the ancestral forms, due to change in their mode of life.
- (c) Coccyx, mammary glands in males, muscles of external ear in human (both male and female) belong to the same category of vestigial organs.
38. The given figures (a) and (b) are chloroplast and mitochondria respectively. Function of thylakoids which is marked as (1) figure (a):-

In thylakoids the primary process of energy transduction occurs i.e. light energy is converted into chemical energy. The reaction centers photosystem I and II are present in thylakoids. It also increases the surface area of inner membrane for photosynthesis.

Function of stroma which is marked as (2) in figure (a) : It has ATP synthetase and e^- carriers. It has enzymes for amino acid synthesis, calvin cycle, fatty acid synthetase, nucleic acid and protein synthesis sulphate reduction.

39.



Photorespiratory Pathway