

AIIMS 2014

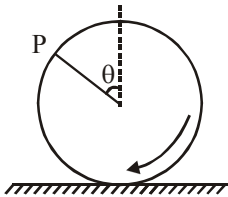
PHYSICS

- A stone tied to the end of a string of 1 m long is whirled in a horizontal circle with a constant speed. If the stone makes 22 revolution in 44 seconds, what is the magnitude and direction of acceleration of the stone?

(a) $\pi^2 \text{ m s}^{-2}$ and direction along the radius towards the centre.
 (b) $\pi^2 \text{ m s}^{-2}$ and direction along the radius away from the centre.
 (c) $\pi^2 \text{ m s}^{-2}$ and direction along the tangent to the circle.
 (d) $\pi^2/4 \text{ m s}^{-2}$ and direction along the radius towards the centre.
- If the temperature of the sun were to increase from T to 2T and its radius from R to 2R, then the ratio of the radiant energy received on earth to what it was previously will be

(a) 32 (b) 16
 (c) 4 (d) 64
- A wheel is rolling straight on ground without slipping. If the axis of the wheel has speed v, the instantaneous velocity of a point P on the rim, defined by angle θ , relative to the ground will be

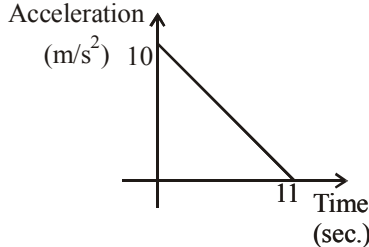
(a) $v \cos\left(\frac{1}{2}\theta\right)$
 (b) $2v \cos\left(\frac{1}{2}\theta\right)$
 (c) $v(1 + \sin \theta)$
 (d) $v(1 + \cos \theta)$


- The dimensions of $\left(\frac{1}{2}\right)\epsilon_0 E^2$ (ϵ_0 : permittivity of free space, E electric field) are

(a) $[\text{MLT}^{-1}]$ (b) $[\text{ML}^2\text{T}^{-2}]$
 (c) $[\text{ML}^{-1}\text{T}^{-2}]$ (d) $[\text{ML}^2\text{T}^{-1}]$
- A fork of frequency 256 Hz resonates with a closed organ pipe of length 25.4 cm. If the length of pipe be increased by 2 mm, the number of beats/sec. will be

(a) 4 (b) 1
 (c) 2 (d) 3
- A body starts from rest from a point distance R_0 from the centre of the earth. The velocity acquired by the body when it reaches the surface of the earth will be (R represents radius of the earth).

(a) $2GM\left(\frac{1}{R} - \frac{1}{R_0}\right)$
 (b) $\sqrt{2GM\left(\frac{1}{R_0} - \frac{1}{R}\right)}$
 (c) $GM\left(\frac{1}{R} - \frac{1}{R_0}\right)$
 (d) $2GM\sqrt{\left(\frac{1}{R} - \frac{1}{R_0}\right)}$
- A body starts from rest at time $t = 0$, the acceleration time graph is shown in the figure. The maximum velocity attained by the body will be

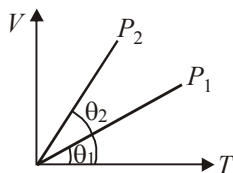


(a) 110 m/s (b) 55 m/s
 (c) 650 m/s (d) 550 m/s

8. A water tank of height 10m, completely filled with water is placed on a level ground. It has two holes one at 3 m and the other at 7 m from its base. The water ejecting from
- both the holes will fall at the same spot
 - upper hole will fall farther than that from the lower hole
 - upper hole will fall closer than that from the lower hole
 - more information is required
9. The potential energy of a satellite of mass m and revolving at a height R_e above the surface of earth where R_e = radius of earth, is

- $-m g R_e$
- $\frac{-m g R_e}{2}$
- $\frac{-m g R_e}{3}$
- $\frac{-m g R_e}{4}$

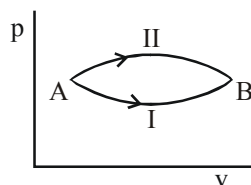
10. The figure shows the volume V versus temperature T graphs for a certain mass of a perfect gas at two constant pressures of P_1 and P_2 . What inference can you draw from the graphs?



- $P_1 > P_2$
 - $P_1 < P_2$
 - $P_1 = P_2$
 - No inference can be drawn due to insufficient information.
11. A mass is hanging on a spring balance which is kept in a lift. The lift ascends. The spring balance will show in its readings
- an increase
 - a decrease
 - no change
 - a change depending on its velocity
12. Which of the following relation is true?
- $3Y = K(1 - \sigma)$
 - $K = \frac{9\eta Y}{Y + \eta}$
 - $\sigma = (6K + \eta)Y$
 - $\sigma = \frac{0.5Y - \eta}{\eta}$
13. $y = 2 \text{ (cm)} \sin \left[\frac{\pi t}{2} + \phi \right]$ what is the maximum acceleration of the particle doing the S.H.M.

- $\frac{\pi}{2} \text{ cm/s}^2$
- $\frac{\pi^2}{2} \text{ cm/s}^2$
- $\frac{\pi^2}{4} \text{ cm/s}^2$
- $\frac{\pi}{4} \text{ cm/s}^2$

14. A system goes from A to B via two processes I and II as shown in figure. If ΔU_1 and ΔU_2 are the changes in internal energies in the processes I and II respectively, then



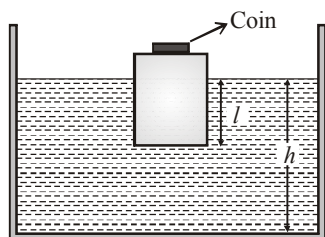
- relation between ΔU_1 and ΔU_2 can not be determined
 - $\Delta U_1 = \Delta U_2$
 - $\Delta U_1 < \Delta U_2$
 - $\Delta U_1 > \Delta U_2$
15. If the linear momentum is increased by 5%, the kinetic energy will increase by
- 50%
 - 100%
 - 125%
 - 10%
16. A crystal has a coefficient of expansion 13×10^{-7} in one direction and 231×10^{-7} in every direction at right angles to it. Then the cubical coefficient of expansion is
- 462×10^{-7}
 - 244×10^{-7}
 - 475×10^{-7}
 - 257×10^{-7}
17. The equation of a progressive wave is

$$y = 0.02 \sin 2\pi \left[\frac{t}{0.01} - \frac{x}{0.30} \right]$$

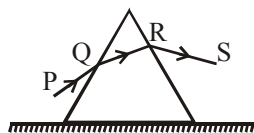
Here x and y are in metre and t is in second. The velocity of propagation of the wave is

- 300 m s^{-1}
 - 30 m s^{-1}
 - 400 m s^{-1}
 - 40 m s^{-1}
18. Two projectiles are fired from the same point with the same speed at angles of projection 60° and 30° respectively. Which one of the following is true?
- Their maximum height will be same
 - Their range will be same
 - Their landing velocity will be same
 - Their time of flight will be same

19. A wooden block, with a coin placed on its top, floats in water as shown in fig. the distance l and h are shown there. After some time the coin falls into the water. Then



- (a) l decreases and h increases
 (b) l increases and h decreases
 (c) both l and h increases
 (d) both l and h decreases
20. Resonance is an example of
 (a) tuning fork (b) forced vibration
 (c) free vibration (d) damped vibration
21. In a medium of dielectric constant K , the electric field is \vec{E} . If ϵ_0 is permittivity of the free space, the electric displacement vector is
 (a) $\frac{K\vec{E}}{\epsilon_0}$ (b) $\frac{\vec{E}}{K\epsilon_0}$
 (c) $\frac{\epsilon_0 \vec{E}}{K}$ (d) $K\epsilon_0 \vec{E}$
22. An inductance L having a resistance R is connected to an alternating source of angular frequency ω . The Quality factor Q of inductance is
 (a) $R/\omega L$ (b) $(\omega L/R)^2$
 (c) $(R/\omega L)^{1/2}$ (d) $\omega L/R$
23. An equilateral prism is placed on a horizontal surface. A ray PQ is incident onto it. For minimum deviation



- (a) PQ is horizontal
 (b) QR is horizontal
 (c) RS is horizontal
 (d) Any one will be horizontal

24. Sky wave propagation is not possible for frequencies

- (a) equal to 30 MHz
 (b) less than 30 MHz
 (c) greater than 30 MHz
 (d) None of these

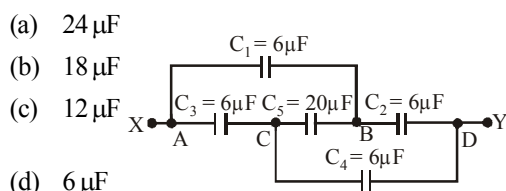
25. A 15.0 eV photon collides with and ionizes a hydrogen atom. If the atom was originally in the ground state (ionization potential = 13.6 eV), what is the kinetic energy of the ejected electron?

- (a) 1.4 eV (b) 13.6 eV
 (c) 15.0 eV (d) 28.6 eV

26. An oscillator is nothing but an amplifier with

- (a) positive feedback
 (b) large gain
 (c) no feedback
 (d) negative feedback

27. What is the effective capacitance between points X and Y?



- (d) 6 μF

28. Magnetic lines of force due to a bar magnet do not intersect because

- (a) a point always has a single net magnetic field
 (b) the lines have similar charges and so repel each other
 (c) the lines always diverge from a single force
 (d) the lines need magnetic lenses to be made to interest

29. 4eV is the energy of incident photon and the work function is 2eV. The stopping potential will be

- (a) 2V (b) 4V
 (c) 6V (d) $2\sqrt{2}$ V

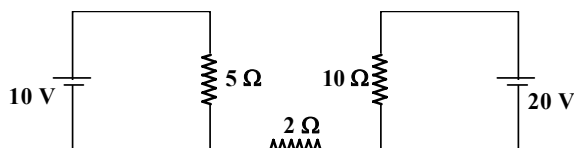
30. Which of the following are not electromagnetic waves?

- (a) cosmic rays (b) γ -rays
 (c) β -rays (d) X-rays.

31. The flux linked with a coil at any instant 't' is given by

- $\phi = 10t^2 - 50t + 250$. The induced emf at $t = 3$ s is
 (a) -190 V (b) -10 V
 (c) 10 V (d) 190 V

32. If we double the radius of a coil keeping the current through it unchanged, then the magnetic field at any point at a large distance from the centre becomes approximately
- (a) double (b) three times
(c) four times (d) one-fourth
33. Find out the value of current through 2Ω resistance for the given circuit

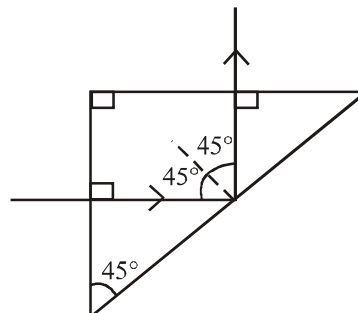


- (a) zero (b) 2 A
(c) 5 A (d) 4 A
34. In Young's double slit experiment, we get 10 fringes in the field of view of monochromatic light of wavelength 4000\AA . If we use monochromatic light of wavelength 5000\AA , then the number of fringes obtained in the same field of view is
- (a) 8 (b) 10
(c) 40 (d) 50
35. A radioactive nuclide is produced at the constant rate of n per second (say, by bombarding a target with neutrons). The expected number N of nuclei in existence t seconds after the number is N_0 is given by

- (a) $N = N_0 e^{-\lambda t}$
(b) $N = \frac{n}{\lambda} + N_0 e^{-\lambda t}$
(c) $N = \frac{n}{\lambda} + \left(N_0 - \frac{n}{\lambda}\right) e^{-\lambda t}$
(d) $N = \frac{n}{\lambda} + \left(N_0 + \frac{n}{\lambda}\right) e^{-\lambda t}$

Where λ is the decay constant of the sample

36. A light ray is incident perpendicularly to one face of a 90° prism and is totally internally reflected at the glass-air interface. If the angle of reflection is 45° , we conclude that the refractive index



- (a) $n > \frac{1}{\sqrt{2}}$ (b) $n > \sqrt{2}$
(c) $n < \frac{1}{\sqrt{2}}$ (d) $n < \sqrt{2}$
37. The cold junction of a thermocouple is maintained at 10°C . No thermo e.m.f. is developed when the hot junction is maintained at 530°C . The neutral temperature is
- (a) 260°C (b) 265°C
(c) 270°C (d) 520°C
38. Which of the following statement is incorrect ?
- (a) In LCR series ac circuit, as the frequency of the source increases, the impedance of the circuit first decreases and then increases.
(b) If the net reactance of an LCR series ac circuit is same as its resistance, then the current lags behind the voltage by 45° .
(c) At resonance, the impedance of an ac circuit becomes purely resistive.
(d) Below resonance, voltage leads the current while above it, current leads the voltage.
39. Following diagram performs the logic function of



- (a) XOR gate (b) AND gate
(c) NAND gate (d) OR gate
40. The condition for obtaining secondary maxima in the diffraction pattern due to single slit is
- (a) $a \sin \theta = n\lambda$
(b) $a \sin \theta = (2n - 1) \frac{\lambda}{2}$
(c) $a \sin \theta = (2n - 1) \lambda$
(d) $a \sin \theta = \frac{n\lambda}{2}$

Directions for (Qs. 41 to 60) : In the following questions Assertion and Reason are provided. Each question has 4 choices (a), (b), (c) and (d) for its answer, out of which ONLY ONE is correct. Mark your responses from the following options.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion .
 (b) Both Assertion and Reason are true and Reason is not the correct explanation of Assertion .
 (c) Assertion is true but Reason is false.
 (d) Assertion is false but Reason is true.

41. Assertion : In simple harmonic motion, the velocity is maximum when the acceleration is minimum.

Reason : Displacement and velocity of S.H.M. differ in phase by $\frac{\pi}{2}$.

42. Assertion : Lenz's law violates the principle of conservation of energy.

Reason : Induced emf always opposes the change in magnetic flux responsible for its production.

43. Assertion : The ferromagnetic substance do not obey Curie's law.

Reason : At Curie point a ferromagnetic substance start behaving as a paramagnetic substance.

44. Assertion: A rigid disc rolls without slipping on a fixed rough horizontal surface with uniform angular velocity. Then the acceleration of lowest point on the disc is zero.

Reason : For a rigid disc rolling without slipping on a fixed rough horizontal surface, the velocity of the lowest point on the disc is always zero.

45. Assertion : Adiabatic expansion is always accompanied by fall in temperature.

Reason : In adiabatic process, volume is inversely proportional to temperature.

46. Assertion : Two equipotential surfaces cannot cut each other.

Reason : Two equipotential surfaces are parallel to each other.

47. Assertion: Critical angle is minimum for violet colour.

Reason : Because critical angle $\theta_c = \sin^{-1}\left(\frac{1}{\mu}\right)$ and $\mu \propto \frac{1}{\lambda}$.

48. Assertion : Environmental damage has increased the amount of ozone in the atmosphere.

Reason : Increase of ozone increases the amount of ultraviolet radiation on earth.

49. Assertion : Mean free path of a gas molecules varies inversely as density of the gas.

Reason : Mean free path varies inversely as pressure of the gas.

50. Assertion : The two bodies of masses M and m ($M > m$) are allowed to fall from the same height if the air resistance for each be the same then both the bodies will reach the earth simultaneously.

Reason : For same air resistance, acceleration of both the bodies will be same.

51. Assertion : The escape speed does not depend on the direction in which the projectile is fired.

Reason : Attaining the escape speed is easier if a projectile is fired in the direction the launch site is moving as the earth rotates about its axis.

52. Assertion : Doppler formula for sound wave is symmetric with respect to the speed of source and speed of observer.

Reason : Motion of source with respect to stationary observer is not equivalent to the motion of an observer with respect to stationary source.

53. Assertion : Long distance power transmission is done at high voltage.

Reason : At high voltage supply power losses are less.

54. Assertion : The de-Broglie wavelength of a molecule (in a sample of ideal gas) varies inversely as the square root of absolute temperature.

Reason : The rms velocity of a molecule (in a sample of ideal gas) depends on temperature.

55. Assertion : In a free fall, weight of a body becomes effectively zero.

Reason : Acceleration due to gravity acting on a body having free fall is zero.

56. Assertion: Strain causes the stress in an elastic body.

Reason: An elastic rubber is more plastic in nature.

57. **Assertion :** Diffraction takes place for all types of waves mechanical or non-mechanical, transverse or longitudinal.
Reason : Diffraction's effect are perceptible only if wavelength of wave is comparable to dimensions of diffracting device.
58. **Assertion :** The velocity of flow of a liquid is smaller when pressure is larger and vice-versa.
Reason : According to Bernoulli's theorem, for the stream line flow of an ideal liquid, the total energy per unit mass remains constant.
59. **Assertion :** The ionising power of β -particle is less compared to α -particles but their penetrating power is more.
Reason : The mass of β -particle is less than the mass of α -particle.
60. **Assertion :** It is hotter over the top of a fire than at the same distance on the sides.
Reason : Air surrounding the fire conducts more heat upwards.

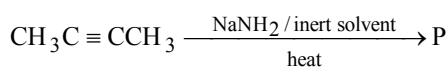
CHEMISTRY

61. K_{sp} of $M(OH)_2$ is 3.2×10^{-11} . The pH of saturated solution in water is
 (a) 3.40 (b) 10.30
 (c) 10.60 (d) 3.70
62. Which is the correct order of stability of the following three carbonium ions ?

$$\begin{array}{ccc} \text{CH}_2 = \text{CH} \overset{+}{\text{C}} \text{HCH}_3 & \text{CH}_2 = \overset{\text{CH}_3}{\underset{|}{\text{C}}} \overset{+}{\text{C}} \text{H}_2 & \text{CH}_3\text{CH} = \text{CH} \overset{+}{\text{C}} \text{H}_2 \\ \text{I} & \text{II} & \text{III} \end{array}$$

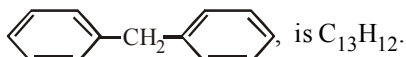
 (a) $I > II > III$
 (b) $II > I > III$
 (c) $I \approx III > II$
 (d) All are equally stable
63. Under the influence of an electric field, the particles in a sol migrate towards cathode. The coagulation of the same sol is studied using NaCl , Na_2SO_4 and Na_3PO_4 solutions. Their coagulating values will be in the order
 (a) $\text{NaCl} > \text{Na}_2\text{SO}_4 > \text{Na}_3\text{PO}_4$
 (b) $\text{Na}_2\text{SO}_4 > \text{Na}_3\text{PO}_4 > \text{NaCl}$
 (c) $\text{Na}_3\text{PO}_4 > \text{Na}_2\text{SO}_4 > \text{NaCl}$
 (d) $\text{Na}_2\text{SO}_4 > \text{NaCl} > \text{Na}_3\text{PO}_4$
64. Which of the following is commercially known as **oxone** ?
 (a) $\text{Na}_2\text{O}_2 + \text{HCl}$ (b) $\text{Na}_2\text{O} + \text{HCl}$
 (c) $\text{Na}_2\text{O}_2 + \text{Na}_2$ (d) none of these
65. The coordination number and the oxidation state of the element 'E' in the complex $[\text{E}(\text{en})_2(\text{C}_2\text{O}_4)]\text{NO}_2$ (where (en) is ethylene diamine) are, respectively,
 (a) 6 and 2 (b) 4 and 2
 (c) 4 and 3 (d) 6 and 3
66. Which compound/set of compounds is used in the manufacture of nylon-66?
 (a) $\text{HOOC}(\text{CH}_2)_4\text{COOH} + \text{H}_2\text{N}(\text{CH}_2)_6\text{NH}_2$
 (b) $\text{CH}_2 = \text{CH}-\text{C}(\text{CH}_3) = \text{CH}_2$
 (c) $\text{CH}_2 = \text{CH}_2$
 (d) $\text{HOOC}-\text{C}_6\text{H}_4-\text{COOH} + \text{HOCH}_2-\text{CH}_2\text{OH}$
67. Carbon cannot be used to produce magnesium by chemical reduction of MgO because:
 (a) Carbon is not a powerful reducing agent
 (b) Magnesium reacts with carbon to form carbides
 (c) Carbon does not react with magnesium
 (d) Carbon is a non-metal
68. A bottle of dry ammonia and a bottle of dry hydrogen chloride connected through a long tube are opened simultaneously at both ends the white ammonium chloride ring first formed will be
 (a) at the centre of the tube.
 (b) near the hydrogen chloride bottle.
 (c) near the ammonia bottle.
 (d) throughout the length of the tube.
69. The electrons, identified by quantum numbers n and l (i) $n=4, l=1$ (ii) $n=4, l=0$ (iii) $n=3, l=2$ (iv) $n=3, l=1$ can be placed in order of increasing energy, from the lowest to highest, as
 (a) (iv) < (ii) < (iii) < (i)
 (b) (ii) < (iv) < (i) < (iii)
 (c) (i) < (iii) < (ii) < (iv)
 (d) (iii) < (i) < (iv) < (ii)

70. A broad spectrum antibiotic is
 (a) paracetamol (b) penicillin
 (c) aspirin (d) chloramphenicol
71. Carborundum is obtained when silica is heated at high temperature with
 (a) carbon
 (b) carbon monoxide
 (c) carbon dioxide
 (d) calcium carbonate
72. Predict the nature of P in the following reaction



- (a) $\text{CH}_2=\text{CHCH}=\text{CH}_2$
 (b) $\text{CH}_2=\text{C}=\text{CH}-\text{CH}_3$
 (c) $\text{CH}_3\text{CH}_2\text{C}\equiv\text{CH}$
 (d) No reaction
73. If AgI crystallises in zinc blende structure with I^- ions at lattice points. What fraction of tetrahedral voids is occupied by Ag^+ ions?
 (a) 25% (b) 50%
 (c) 100% (d) 75%

74. The molecular formula of diphenyl methane,



How many structural isomers are possible when one of the hydrogens is replaced by a chlorine atom?

- (a) 6 (b) 4
 (c) 8 (d) 7
75. The element with atomic number 117 has not been discovered yet. In which family would you place this element if discovered?
 (a) Alkali metals
 (b) Alkaline earth metals
 (c) Halogens
 (d) Noble gases
76. Ethanoic acid on heating with ammonia forms compound A which on treatment with bromine and sodium hydroxide gives compound B. Compound B on treatment with $\text{NaNO}_2/\text{dil. HCl}$ gives compound C. The compounds A, B and C respectively are
 (a) ethanamide, methanamine, methanol
 (b) propanamide, ethanamine, ethanol
 (c) N-ethylpropanamide, methanisonitrile, methanamine
 (d) ethanamine, bromoethane, ethanediazonium chloride

77. Compound 'A' of molecular formula $\text{C}_4\text{H}_{10}\text{O}$ on treatment with Lucas reagent at room temperature gives compound 'B'. When compound 'B' is heated with alcoholic KOH, it gives isobutene. Compound 'A' and 'B' are respectively

- (a) 2-methyl-2-propanol and 2-methyl-2-chloropropane
 (b) 2-methyl-1-propanol and 1-chloro-2-methylpropane
 (c) 2-methyl-1-propanol and 2-methyl-2-chloropropane
 (d) butan-2-ol and 2-chlorobutane

78. Which of the following alcohols gives the best yield of dialkyl ether on being heated with a trace of sulphuric acid?

- (a) 2-Pentanol
 (b) Cyclopentanol
 (c) 2-Methyl-2-butanol
 (d) 1-Pentanol

79. Which has the maximum number of molecules among the following ?

- (a) 44 g CO_2 (b) 48 g O_3
 (c) 8 g H_2 (d) 64 g SO_2

80. A 1.0 M with respect to each of the metal halides AX_3 , BX_2 , CX_3 and DX_2 is electrolysed using platinum electrodes. If

$$E_{\text{A}^{3+}/\text{A}}^\circ = 1.50 \text{ V}, E_{\text{B}^{2+}/\text{B}}^\circ = 0.3 \text{ V}, E_{\text{C}^{3+}/\text{C}}^\circ = -0.74 \text{ V},$$

$$E_{\text{D}^{2+}/\text{D}}^\circ = -2.37 \text{ V. The correct sequence in}$$

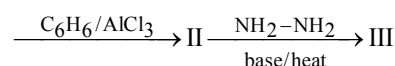
which the various metals are deposited at the cathode is

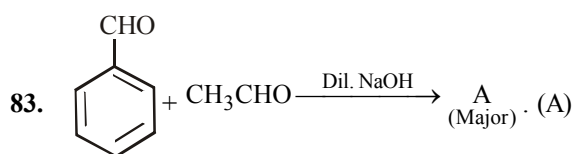
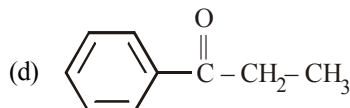
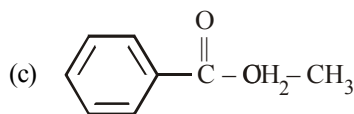
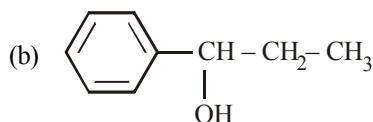
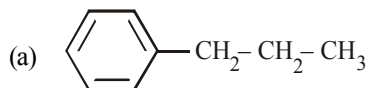
- (a) A, B, C, D (d) A, B, C
 (c) D, C, B, A (b) C, B, A

81. In the isoelectronic series of metal carbonyl, the CO bond strength is expected to increase in the order:

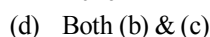
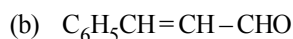
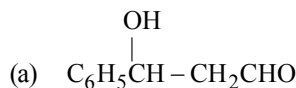
- (a) $[\text{Mn}(\text{CO})_6]^+ < [\text{Cr}(\text{CO})_6] < [\text{V}(\text{CO})_6]^-$
 (d) $[\text{V}(\text{CO})_6]^- < [\text{Cr}(\text{CO})_6] < [\text{Mn}(\text{CO})_6]^+$
 (c) $[\text{V}(\text{CO})_6]^- < [\text{Mn}(\text{CO})_6]^+ < [\text{Cr}(\text{CO})_6]$
 (b) $[\text{Cr}(\text{CO})_6] < [\text{Mn}(\text{CO})_6]^+ < [\text{V}(\text{CO})_6]^-$

82. The final product (III) obtained in the reaction sequence –





will be –



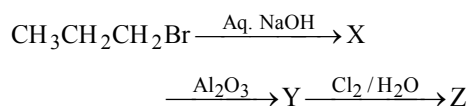
84. What is the enthalpy change for,
 $2\text{H}_2\text{O}_2(l) \rightarrow 2\text{H}_2\text{O}(l) + \text{O}_2(g)$ if heat of formation of $\text{H}_2\text{O}_2(l)$ and $\text{H}_2\text{O}(l)$ are -188 and -286 kJ/mol respectively?

- (a) -196 kJ/mol (b) $+948$ kJ/mol
 (c) $+196$ kJ/mol (d) -948 kJ/mol

85. Which of the following equilibria will shift to right side on increasing the temperature?

- (a) $\text{CO}(g) + \text{H}_2\text{O}(g) \rightleftharpoons \text{CO}_2(g) + \text{H}_2(g)$
 (b) $2\text{SO}_2(g) + \text{O}_2(g) \rightleftharpoons 2\text{SO}_3(g)$
 (c) $\text{H}_2\text{O}(g) \rightleftharpoons \text{H}_2(g) + \frac{1}{2}\text{O}_2(g)$
 (d) $4\text{HCl}(g) + \text{O}_2(g) \rightleftharpoons 2\text{H}_2\text{O}(g) + 2\text{Cl}_2(g)$

86. Identify Z in



- (a) Mixture of $\text{CH}_3\text{CHClCH}_2\text{Cl}$ and $\text{CH}_3\text{CHOHCH}_2\text{Cl}$
 (b) $\text{CH}_3\text{CHOHCH}_2\text{Cl}$
 (c) $\text{CH}_3\text{CHClCH}_2\text{OH}$
 (d) $\text{CH}_3\text{CHClCH}_2\text{Cl}$

87. Which of the following is paramagnetic?

- (a) $[\text{Fe}(\text{CN})_6]^{4-}$ (b) $[\text{Ni}(\text{CO})_4]$
 (c) $[\text{Ni}(\text{CO})_4]^{2-}$ (d) $[\text{CoF}_6]^{3-}$

88. Which of the following 0.10 m aqueous solutions will have the lowest freezing point?

- (a) $\text{Al}_2(\text{SO}_4)_3$ (b) $\text{C}_6\text{H}_{12}\text{O}_6$
 (c) KCl (d) $\text{C}_{12}\text{H}_{22}\text{O}_{11}$

89. In hydrogen atomic spectrum, a series limit is found at 12186.3 cm^{-1} . Then it belong to

- (a) Lyman series (b) Balmer series
 (c) Paschen series (d) Brackett series

90. The secondary precursors of photochemical smog are

- (a) SO_2 and NO_2
 (b) SO_2 and hydrocarbons
 (c) NO_2 and hydrocarbons
 (d) O_3 and PAN

91. When Br_2 is treated with aqueous solutions of NaF , NaCl and NaI separately

- (a) F_2 , Cl_2 and I_2 are liberated
 (b) only F_2 and Cl_2 are liberated
 (c) only I_2 is liberated
 (d) only Cl_2 is liberated

92. An inorganic salt (A) is decomposed on heating to give two products (B) and (C). Compound (C) is a liquid at room temperature and is neutral to litmus while the compound (B) is a colourless neutral gas. Compounds (A), (B) and (C) are

- (a) NH_4NO_3 , N_2O , H_2O
 (b) NH_4NO_2 , NO , H_2O
 (c) CaO , H_2O , CaCl_2
 (d) $\text{Ba}(\text{NO}_3)_2$, H_2O , NO_2

93. A solution containing 10g per dm^3 of urea (molecular mass = 60 gmol^{-1}) is isotonic with a 5% solution of a non volatile solute. The molecular mass of this non volatile solute is

- (a) 300 gmol^{-1} (b) 350 gmol^{-1}
 (c) 200 gmol^{-1} (d) 250 gmol^{-1}

94. Which of the following involves transfer of five electrons ?

- (a) $\text{MnO}_4^- \rightarrow \text{Mn}^{2+}$
 (b) $\text{CrO}_4^{2-} \rightarrow \text{Cr}^{3+}$
 (c) $\text{MnO}_4^{2-} \rightarrow \text{MnO}_2$
 (d) $\text{Cr}_2\text{O}_7^{2-} \rightarrow 2\text{Cr}^{3+}$

95. The compound $\text{CHCl}=\text{CHCHOHCOOH}$ with molecular formula $\text{C}_4\text{H}_5\text{O}_3\text{Cl}$ can exhibit

- (a) geometric, optical position and functional isomerism
 (b) geometric, optical and functional isomerism only
 (c) position and functional isomerism only
 (d) geometric and optical isomerism only

96. N_2 and O_2 are converted to monovalent cations N_2^+ and O_2^+ respectively. Which is incorrect ?

- (a) In N_2^+ the N-N bond is weakened
 (b) In O_2^+ the bond order increases
 (c) In O_2^+ the paramagnetism decreases
 (d) N_2^+ becomes diamagnetic

97. The gas with the highest critical temperature is

- (a) H_2 (b) He
 (c) N_2 (d) CO_2

98. For osazone formation, the effective structural unit necessary is

- (a) $\begin{array}{c} \text{CH}_2\text{OCH}_3 \\ | \\ \text{CO} \\ | \end{array}$ (b) $\begin{array}{c} \text{CH}_2\text{OH} \\ | \\ \text{CO} \\ | \end{array}$
 (c) $\begin{array}{c} \text{CH}_2\text{OH} \\ | \\ \text{CHOCH}_3 \\ | \end{array}$ (d) $\begin{array}{c} \text{CHO} \\ | \\ \text{CHOCH}_3 \\ | \end{array}$

99. Half-lives of a first order and a zero order reaction are same. Then the ratio of the initial rates of first order reaction to that of the zero order reaction is

- (a) $\frac{1}{0.693}$ (b) 2×0.693
 (c) 0.693 (d) $\frac{2}{0.693}$

100. Which of the following would not give 2-phenylbutane as the major product in a Friedel-Crafts alkylation reaction ?

- (a) 1-butene + HF
 (b) 2-butanol + H_2SO_4
 (c) Butanoyl chloride + AlCl_3 then Zn, HCl
 (d) Butyl chloride + AlCl_3

Directions for (Qs. 100 to 120) : In the following questions Assertion and Reason are provided. Each question has 4 choices (a), (b), (c) and (d) for its answer, out of which ONLY ONE is correct. Mark your responses from the following options.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion .
 (b) Both Assertion and Reason are true and Reason is not the correct explanation of Assertion .
 (c) Assertion is true but Reason is false.
 (d) Assertion is false but Reason is true.

101. **Assertion :** LiCl is predominantly a covalent compound.

Reason : Electronegativity difference between Li and Cl is too small.

102. **Assertion :** In the third group of qualitative analysis, NH_4Cl is added to NH_4OH medium.

Reason : This is to convert the ions of group into their respective chlorides.

103. **Assertion :** On increasing dilution, the specific conductance keep on increasing.

Reason : On increasing dilution, degree of ionisation of weak electrolyte increases and molality of ions also increases.

104. **Assertion :** During electrolysis of $\text{CuSO}_4(\text{aq})$ using copper electrodes, copper is dissolved at anode and deposited at cathode.

Reason : Oxidation takes place at anode and reduction at cathode.

105. **Assertion:** Phenol undergo Kolbe reaction, ethanol does not.

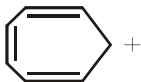
Reason : Phenoxide ion is more basic than ethoxide ion.

106. **Assertion :** HOF bond angle in HFO is higher than HOCl bond angle in HClO.

Reason : Oxygen is more electronegative than halogens.

107. **Assertion :** Spin quantum number can have two values, $+\frac{1}{2}$ and $-\frac{1}{2}$.

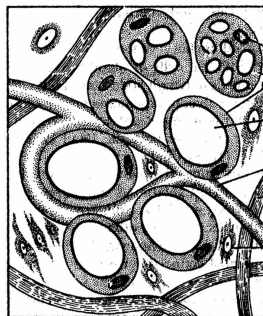
Reason : + and - signs signify the positive and negative wave functions.

- 108. Assertion :** On heating ferromagnetic or ferrimagnetic substances, they become paramagnetic.
Reason : The electrons change their spin on heating.
- 109. Assertion :** Trans-2-butene on reaction with Br_2 gives meso-2, 3-dibromobutane.
Reason : The reaction involves syn-addition of bromine.
- 110. Assertion :** Pb^{4+} compounds are stronger oxidizing agents than Sn^{4+} compounds.
Reason : The higher oxidation states for the group 14 elements are more stable for the heavier members of the group due to 'inert pair effect'.
- 111. Assertion :** Greater the value of van der Waal's constant 'a' greater is the liquefaction of gas.
Reason : 'a' indirectly measures the magnitude of attractive forces between the molecules.
- 112. Assertion :** Tropylium cation is aromatic in nature
- 
- Reason :** The only property that determines its aromatic behaviour is its planar structure.
- 113. Assertion :** For a reaction $2\text{NH}_3(\text{g}) \rightarrow \text{N}_2(\text{g}) + 3\text{H}_2(\text{g})$; $\Delta H > \Delta E$.
Reason : Enthalpy change is always greater than internal energy change.
- 114. Assertion :** Glucose and fructose give the same osazone.
Reason : During osazone formation stereochemistry only at C_1 and C_2 is destroyed.
- 115. Assertion :** The addition of BHA to butter increases its storage life from months to years.
Reason : Butylated hydroxy anisole (BHA) is an antioxidant.
- 116. Assertion :** Ethylenediaminetetra acetate ion forms an octahedral complex with the metal ion.
Reason : It has six donor atoms which coordinate simultaneously to the metal ion.
- 117. Assertion :** Cuprous ion (Cu^+) has unpaired electrons while cupric ion (Cu^{++}) does not.
Reason : Cuprous ion (Cu^+) is colourless whereas cupric ion (Cu^{++}) is blue in the aqueous solution
- 118. Assertion :** K, Rb and Cs (all belonging to group 1) can also form superoxides.
Reason : The ionic radii of K, Rb and Cs show the following trend $\text{Cs}^+ < \text{Rb}^+ < \text{K}^+$.
- 119. Assertion :** Benzaldehyde is more reactive than ethanol towards nucleophilic attack.
Reason : The overall effect of $-I$ and $+R$ effect of phenyl group decreases the electron density on the carbon atom of $>\text{C}=\text{O}$ group in benzaldehyde.
- 120. Assertion :** Acetamide reacts with Br_2 in presence of methanolic CH_3ONa to form methyl N-methyl carbamate.
Reason : Methyl isocyanate is formed as an intermediate which reacts with methanol to form methyl N-methylcarbamate.

BIOLOGY

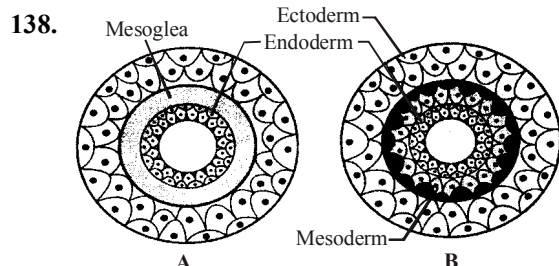
- 121.** Sclerenchyma usually _____ and _____ protoplasts.
 (a) live, without (b) dead, with
 (c) live, with (d) dead, without
- 122.** In which method of transport in plasma membrane does not require carrier molecule?
 (a) Active transport
 (b) Facilitated diffusion
 (c) Simple diffusion
 (d) $\text{Na}^+ - \text{K}^+$ pump
- 123.** Read the following statements
 (i) Lower the taxon, more are the characteristics that the members within the taxon share.
 (ii) Order is the assemblage of genera which exhibit a few similar characters.
- (iii) Cat and dog are included in the same family Felidae.
 (iv) Binomial Nomenclature was introduced by Carolus Linnaeus.
- Which of the following statements are **NOT** correct?
 (a) (i), (ii) and (iii) (b) (ii), (iii) and (iv)
 (c) (i) and (iv) (d) (ii) and (iii)
- 124.** Which one of the following is a non-reducing carbohydrate?
 (a) Maltose
 (b) Sucrose
 (c) Lactose
 (d) Ribose 5-phosphate

125. Which of the metabolites is common to respiration mediated breakdown of fats, carbohydrates and proteins?
 (a) Fructose 1, 6 - biphosphate
 (b) Pyruvic acid
 (c) Acetyl CoA
 (d) Glucose - 6 - phosphate
126. Cockroaches are brown or black bodied animals that are included in class _____ of phylum _____.
 (a) Reptilia; Annelida
 (b) Insecta; Arthropoda
 (c) Insecta; Annelida
 (d) Reptilia; Arthropoda
127. The K_m value of the enzyme is the value of the substrate concentration at which the reaction reaches to
 (a) Zero (b) $2V_{max}$
 (c) $\frac{1}{2}V_{max}$ (d) $\frac{1}{4}V_{max}$
128. Which one of the following is correctly matched?
 (a) Onion – Bulb
 (b) Ginger – Sucker
 (c) *Chlamydomonas* – Conidia
 (d) Yeast – Zoospores
129. Match column-I with column-II and select the option .
- | Column-I
(Classes of fungi) | Column-II
(Common name) |
|--------------------------------|----------------------------|
| A. Phycomycetes | I. Sac fungi |
| B. Ascomycetes | II. Algal fungi |
| C. Basidiomycetes | III. Fungi imperfecti |
| D. Deuteromycetes | IV. Club fungi |
- The correct combination is –
 (a) A – II, B – I, C – IV, D – III
 (b) A – II, B – IV, C – I, D – III
 (c) A – IV, B – I, C – II, D – III
 (d) A – IV, B – III, C – II, D – I
130. Approximately seventy percent of carbon-dioxide absorbed by the blood will be transported to the lungs
 (a) as bicarbonate ions
 (b) in the form of dissolved gas molecules
 (c) by binding to RBC
 (d) as carbamino - haemoglobin
131. Seed increase in its volume by the adsorption of water through
 (a) Osmosis (b) Plasmolysis
 (c) Imbibition (d) Diffusion
132. Select the correct option describing gonadotropin activity in a normal pregnant female:
 (a) High level of FSH and LH stimulate the thickening of endometrium.
 (b) High level of FSH and LH facilitate implantation of the embryo.
 (c) High level of hCG stimulates the synthesis of estrogen and progesterone.
 (d) High level of hCG stimulates the thickening of endometrium.
133. If the cells of root in wheat plant have 42 chromosomes, then the no. of chromosome in the cell of pollen grain is
 (a) 14 (b) 21
 (c) 28 (d) 42
134. Select the correct option:
 Direction of RNA synthesis Direction of reading of the template DNA strand
 (a) 5'—3' 3'—5'
 (b) 3'—5' 5'—3'
 (c) 5'—3' 5'—3'
 (d) 3'—5' 3'—5'
135. Forelimbs of cat, lizard used in walking; forelimbs of whale used in swimming and forelimbs of bats used in flying are an example of
 (a) Analogous organs
 (b) Adaptive radiation
 (c) Homologous organs
 (d) Convergent evolution
136. Identify the figure with its correct function



- (a) Areolar connective tissue – Serves as a support framework for epithelium
 (b) Adipose tissue – Store fats and act as heat insulators
 (c) Dense regular tissue – Provide flexibility
 (d) Dense irregular tissue – Provide strength and elasticity

137. Which of the following is a variety of *Brassica* resistance to white rust disease?
- Himgiri*
 - Pusa Kamal*
 - Pusa Swarnim (Karan rai)*
 - Pusa Sadabahar*



The above diagram shows the germs layer. The animals having structures shown in the figures A and B are respectively called

- Diploblastic, Triploblastic
 - Triploblastic, Diploblastic
 - Diploblastic, Diploblastic
 - Triploblastic, Triploblastic
139. Chloramphenicol and erythromycin (broad spectrum antibiotics) are produced by
- Streptomyces*
 - Nitrobacter*
 - Rhizobium*
 - Penicillium*
140. Read the following statements.
- Gynoecium is situated in the centre and other parts of the flower are located on the rim of the thalamus almost at the same level.
 - Ovary is half-inferior.
 - Examples are plum, rose and peach.
- Which condition of flowers is being described by the above statements ?
- Hypogyny
 - Perigyny
 - Epigyny
 - None of these
141. A patient brought to a hospital with myocardial infarction is normally immediately given:
- Penicillin
 - Streptokinase
 - Cyclosporin-A
 - Statins
142. Select the correct matching of the type of the joint with the example in human skeletal system:
- | Type of joint | Example |
|-------------------------|---|
| (a) Cartilaginous joint | between frontal and parietal |
| (b) Pivot joint | between third and fourth cervical vertebrae |
| (c) Hinge joint | between humerus and pectoral girdle |
| (d) Gliding joint | between carpals |

143. Which one of the following represents a palindromic sequence in DNA?

- 5' - GAATTC - 3'
3' - CTTAAG - 5'
- 5' - CCAATG - 3'
3' - GAATCC - 5'
- 5' - CATTAG - 3'
3' - GATAAC - 5'
- 5' - GATACC - 3'
3' - CCTAAG - 5'

144. During meiosis I, the chromosomes start pairing at

- Leptotene
- Zygotene
- Pachytene
- Diplotene

145. Which of the following is based upon the principle of antigen-antibody interaction?

- PCR
- ELISA
- r-DNA technology
- RNA

146. If both parents are carriers for thalassemia, which is an autosomal recessive disorder, what are the chances of pregnancy resulting in an affected child?

- 50%
- 25%
- 100%
- no chance

147. The total requirement of ATP & NADPH for each molecule of CO₂ fixed & reduced in photosynthesis in the Calvin cycle is

- 2 ATP & 2 NADPH
- 2 ATP & 3 NADPH
- 3 ATP & 2 NADPH
- 4 ATP & 3 NADPH

148. The rate of formation of new organic matter by rabbit in a grassland, is called

- Net productivity
- Secondary productivity
- Net primary productivity
- Gross primary productivity

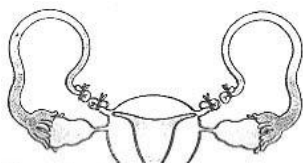
149. The largest Tiger reserve in India is

- Nagarhole
- Valmiki
- Nagarjunsagar-Srisailem
- Periyar

150. Which of the following is an **INCORRECT** match of essential element and function?

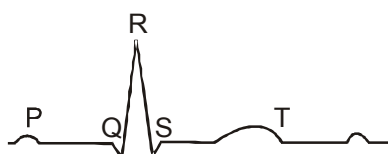
- Manganese - structural component of chlorophyll.
- Calcium - component of the middle lamella.
- Zinc - enzyme activator.
- Iron - component of ferredoxin.

151. The two gases making the highest relative contribution to the greenhouse gases are
 (a) CO_2 and CH_4 (b) CH_4 and N_2O
 (c) CFC_5 and N_2O (d) CO_2 and N_2O
152. Geitonogamy involves:
 (a) fertilization of a flower by the pollen from another flower of the same plant.
 (b) fertilization of a flower by the pollen from the same flower.
 (c) fertilization of a flower by the pollen from a flower of another plant in the same population.
 (d) fertilization of a flower by the pollen from a flower of another plant belonging to a distant population.
153. Genes of interest can be selected from a genomic library by using
 (a) Restriction enzymes
 (b) Cloning vectors
 (c) DNA probes
 (d) Gene targets
154. A healthy person eats the following diet - 5 gm raw sugar, 4 gm albumin, 10 gm pure buffalo ghee adulterated with 2 gm vegetable ghee (hydrogenated vegetable oil) and 5 gm lignin. How many calories he is likely to get?
 (a) 144 (b) 126
 (c) 164 (d) 112
155. A population is in Hardy-Weinberg equilibrium for a gene with only two alleles. If the gene frequency of an allele A is 0.7, the genotype frequency of Aa is
 (a) 0.21 (b) 0.42
 (c) 0.36 (d) 0.7
156. What is the figure given below showing in particular?



- (a) Ovarian cancer (b) Uterine cancer
 (c) Tubectomy (d) Vasectomy

157. The diagram given here is the standard ECG of a normal person, the P-wave represents the :



- (a) Initiation of the ventricular contraction
 (b) Beginning of the systole
 (c) End of systole
 (d) Contraction of both the atria

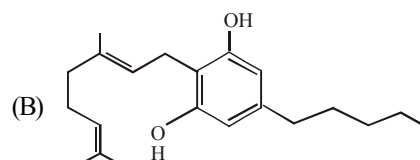
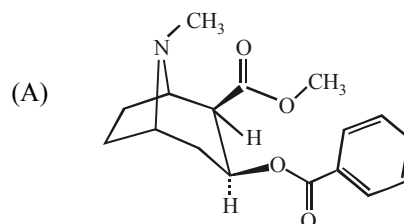
158. If 4 individuals in a laboratory population of 40 fruitflies died during a specified time interval (*i.e.*, a week), the death rate in the population during that period is

- (a) 1 (b) 0.1
 (c) 0.01 (d) 0.4

159. The first clinical gene therapy was given in 1990 to a 4 years old girl with enzyme deficiency of

- (a) Adenosine deaminase (ADA)
 (b) Tyrosine oxidase
 (c) Monamine oxidase
 (d) Glutamate dehydrogenase

160. Identify the molecules (A) and (B) shown below and select the right option giving their source and use.



	Molecule	Source	Uses
(a)	(A) Cocaine	<i>Erythroxylum coca</i>	Accelerates the transport of dopamine
(b)	(B) Heroin	<i>Cannabis sativa</i>	Depressant and slows down body functions
(c)	(B) Cannabinoid	<i>Atropa belladonna</i>	Produces hallucinations
(d)	(A) Morphine	<i>Papaver somniferum</i>	Sedative and pain killer

Directions for (Qs. 161 to 180) : In the following questions Assertion and Reason are provided. Each question has 4 choices (a), (b), (c) and (d) for its answer, out of which ONLY ONE is correct. Mark your responses from the following options.

- (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion .
- (b) Both Assertion and Reason are true and Reason is not the correct explanation of Assertion .
- (c) Assertion is true but Reason is false.
- (d) Both the Assertion and Reason are incorrect.

161. Assertion : Taxon and category are different things.

Reason : Category shows hierarchical classification.

162. Assertion : Deficiency of sulphur causes chlorosis in plants.

Reason : Sulphur is a constituent of chlorophyll, protein and nucleic acids.

163. Assertion : Hemodialysis can save and prolong the life of uremic patients.

Reason : Waste products like urea can be removed from the blood by the process of hemodialysis.

164. Assertion : Leaves of *Bryophyllum*, *Begonia* help in vegetative multiplication.

Reason : Leaves of these plants possess adventitious buds.

165. Assertion : Enzymes lower the activation energy.

Reason : A substrate molecule can be acted upon by a particular enzyme.

166. Assertion : Head of sperm consists of acrosome and mitochondria.

Reason : Acrosome contains spiral row of mitochondria.

167. Assertion : Mitochondria and chloroplasts are semi autonomous organelles.

Reason : They are formed by division of pre-existing organelles as well as contain DNA but lack protein synthesizing machinery.

168. Assertion : In *Mirabilis*, selfing of F_1 pink flower plants produces same phenotypic & genotypic ratio.

Reason : Flower colour gene shows incomplete dominance.

169. Assertion : Vitamins B_2 is found in cereals, green vegetables, brewer's yeast, egg white, milk and liver.

Reason : It can be commercially produced by some yeasts.

170. Assertion : Sponges belong to Porifera.

Reason : Sponges have canal system.

171. Assertion : HIV infection can be avoided by use of condoms.

Reason : Condoms secrete anti-viral interferons.

172. Assertion : Glycolysis occurs in cytoplasm.

Reason : Enzymes for glycolysis are found in cytoplasm. It is common in aerobic/anaerobic respiration.

173. Assertion : Apical meristem of root is subterminal.

Reason : At the terminal end of root, root cap is present.

174. Assertion : Copper-T is an effective contraceptive device in human females.

Reason : Copper-T prevents passage of sperms from vagina upwards into fallopian tubes.

175. Assertion : Diversity observed in the entire geographical area is called gamma diversity.

Reason : Biodiversity decreases from high altitude to low altitude.

176. Assertion : Females have less stature than males after puberty.

Reason : This happens because of the presence of hCG in the blood of females.

177. Assertion : The uptake of DNA during transformation is an active, energy requiring process.

Reason : Transformation occurs in only those bacteria, which possess the enzymatic machinery involved in the active uptake and recombination.

178. Assertion : UAA, UAG and UGA terminate protein synthesis.

Reason : They are not recognised by tRNA.

179. Assertion : A sanctuary is formed for the conservation of animals only.

Reason : Restricted human activities are allowed in sanctuaries.

180. Assertion : Interferons are effective against viruses.

Reason : Proteins which can be synthesized only by genetic engineering are effective against viruses.

GENERAL KNOWLEDGE

- 181.** Which one among the following is the correct order of power consumption for light of equal intensity ?
- (a) CFL tube < Fluorescent tube < Incandescent bulb < Light emitting diode
(b) Light emitting diode < CFL tube < Fluorescent tube < Incandescent bulb
(c) CFL tube < Fluorescent tube < Light emitting diode < Incandescent bulb
(d) Incandescent bulb < Light emitting diode < Fluorescent tube < CFL tube
- 182.** Who is the author of the book 'Conquest of Self'?
- (a) Aurobindo Ghosh
(b) Rabindra Nath Tagore
(c) Mahatma Gandhi
(d) S. Radhakrishnan
- 183.** The black part of the moon is always calm and dark which is called
- (a) Sea of tranquility (b) Ocean of storms
(c) Area of storms (d) None of these
- 184.** Who is known as the 'Picasso of India'?
- (a) Amrita Shergil (b) M.F. Hussain
(c) Sudhir Vyas (d) Shafqat Hussain
- 185.** The earth's magnetic field always has a vertical component except at the
- (a) magnetic equator
(b) magnetic poles
(c) geographic north pole
(d) latitude 45°
- 186.** When a particle and an antiparticle come in contact with each other, they
- (a) repel each other
(b) annihilate each other
(c) go undisturbed
(d) spin about a common axis
- 187.** Photoelectric effect is
- (a) an instantaneous process
(b) delayed process
(c) emission of protons
(d) emission of neutrons
- 188.** Candles contains a mixture of
- (a) Bees wax and paraffin wax
(b) Bees wax and stearic acid
(c) Paraffin wax and stearic acid
(d) Higher fatty acid
- 189.** In chemical terms, what are alums used for purifying water for drinking purposes ?
- (a) Hydrated chlorides
(b) Double nitrate
(c) Double sulphates
(d) Nitrates of aluminium
- 190.** Each body segment of Earthworm is called
- (a) Proglottid (b) Metamere
(c) Scolex (d) Rostellum
- 191.** Which is the capital of Mali ?
- (a) Mopti (b) Bamako
(c) Cairo (d) Nairobi
- 192.** Who among the following first propounded the idea of Basic Education?
- (a) Jawahar Lal Nehru
(b) Raja Ram Mohan Roy
(c) Mahatma Gandhi
(d) Dayanand Saraswati
- 193.** The hydraulic brake used in automobiles is a direct application of
- (a) Archimedes' principle
(b) Torricellian law
(c) Bernoulli's Theorem
(d) Pascal's law
- 194.** Of the following, which is the fastest?
- (a) CD-ROM (b) RAM
(c) Registers (d) Cache

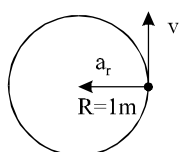
195. Which one of the following though called a garden is infact, not a garden?
- (a) Vrindavan Garden of Mysore
 - (b) Hanging Garden of Mumbai
 - (c) Eden Garden of Kolkata
 - (d) Shalimar Garden of Kashmir
196. Who advocated the adoption of 'PURA' model to eradicate rural poverty?
- (a) Dr. A. P. J. Abdul Kalam
 - (b) Sri Abhijit Sen
 - (c) Maulana Abdul Kalam Azad
 - (d) Prof. A. M. Patha
197. How many articles are there in the Indian constitution?
- (a) 395
 - (b) 396
 - (c) 398
 - (d) 399
198. Who caught the wicket of Sachin Tendulkar in his last match?
- (a) Chris Gayle
 - (b) Darren Sammy
 - (c) Shiv Narayan Chandrapaul
 - (d) Dwane Bravo
199. 'Splenic fever' is another name for
- (a) FMD
 - (b) Anthrax
 - (c) Cow pox
 - (d) Mastitis
200. Which place in India is called "The Golden Mine of Liverworts"?
- (a) Eastern Himalayas
 - (b) Western Himalayas
 - (c) Western Ghats
 - (d) Eastern Ghats

ANSWER KEY																			
1	(a)	21	(d)	41	(b)	61	(c)	81	(b)	101	(c)	121	(d)	141	(b)	161	(a)	181	(b)
2	(d)	22	(d)	42	(a)	62	(c)	82	(a)	102	(c)	122	(c)	142	(d)	162	(c)	182	(c)
3	(b)	23	(b)	43	(c)	63	(a)	83	(b)	103	(d)	123	(d)	143	(a)	163	(a)	183	(a)
4	(c)	24	(c)	44	(a)	64	(a)	84	(a)	104	(a)	124	(b)	144	(b)	164	(a)	184	(b)
5	(c)	25	(a)	45	(d)	65	(d)	85	(c)	105	(c)	125	(c)	145	(b)	165	(b)	185	(a)
6	(b)	26	(a)	46	(d)	66	(a)	86	(b)	106	(d)	126	(b)	146	(b)	166	(c)	186	(b)
7	(b)	27	(d)	47	(b)	67	(b)	87	(d)	107	(c)	127	(c)	147	(c)	167	(c)	187	(a)
8	(a)	28	(a)	48	(a)	68	(b)	88	(a)	108	(a)	128	(a)	148	(b)	168	(a)	188	(c)
9	(b)	29	(a)	49	(a)	69	(a)	89	(c)	109	(c)	129	(a)	149	(c)	169	(b)	189	(c)
10	(b)	30	(c)	50	(a)	70	(d)	90	(d)	110	(c)	130	(a)	150	(a)	170	(b)	190	(d)
11	(a)	31	(b)	51	(c)	71	(a)	91	(c)	111	(a)	131	(c)	151	(a)	171	(c)	191	(b)
12	(d)	32	(c)	52	(d)	72	(c)	92	(a)	112	(c)	132	(c)	152	(a)	172	(a)	192	(c)
13	(b)	33	(a)	53	(a)	73	(b)	93	(a)	113	(c)	133	(b)	153	(c)	173	(a)	193	(d)
14	(b)	34	(a)	54	(a)	74	(b)	94	(a)	114	(a)	134	(a)	154	(a)	174	(c)	194	(c)
15	(d)	35	(c)	55	(d)	75	(c)	95	(a)	115	(a)	135	(c)	155	(b)	175	(a)	195	(c)
16	(a)	36	(b)	56	(a)	76	(a)	96	(d)	116	(a)	136	(b)	156	(c)	176	(c)	196	(a)
17	(b)	37	(c)	57	(c)	77	(a)	97	(d)	117	(d)	137	(c)	157	(d)	177	(a)	197	(a)
18	(b)	38	(d)	58	(a)	78	(d)	98	(b)	118	(c)	138	(a)	158	(b)	178	(a)	198	(b)
19	(d)	39	(b)	59	(b)	79	(c)	99	(b)	119	(a)	139	(a)	159	(a)	179	(a)	199	(b)
20	(b)	40	(b)	60	(c)	80	(b)	100	(c)	120	(a)	140	(b)	160	(d)	180	(c)	200	(b)

HINTS & SOLUTIONS

PHYSICS

1. (a) $a_r = \omega^2 R$



$$a_r = (2\pi)^2 R = 4\pi^2 2^2 R = 4\pi^2 \left(\frac{22}{44}\right)^2 (1)$$

$$\left[\because v = \frac{22}{44} \right]$$

$$a_t = \frac{dv}{dt} = 0$$

$a_{\text{net}} = a_r = \pi^2 \text{ ms}^{-2}$ and direction along the radius towards the centre.

2. (d) $E = \sigma AT^4$

$$A \propto R^2 \therefore E \propto R^2 T^4$$

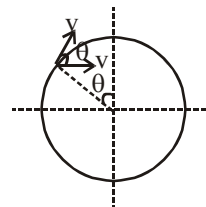
$$\therefore \frac{E_2}{E_1} = \frac{R_2^2 T_2^4}{R_1^2 T_1^4}$$

put $R_2 = 2R, R_1 = R$

$$T_2 = 2T, T_1 = T$$

$$\Rightarrow \frac{E_2}{E_1} = \frac{(2R)^2 (2T)^4}{R^2 T^4} = 64$$

3. (b)



$$v_R = \sqrt{v^2 + v^2 + 2v^2 \cos \theta} = \sqrt{2v^2 (1 + \cos \theta)}$$

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

4. (c) Here $\left(\frac{1}{2}\right)\epsilon_0 E^2$ represents energy per unit volume

$$[\epsilon_0][E^2] = \frac{\text{Energy}}{\text{volume}} = \frac{[ML^2T^{-2}]}{[L^3]} = ML^{-1}T^{-2}$$

5. (c) $n_1 = 256 = \frac{v}{4\ell_1} = \frac{v}{4 \times 25.4}$

$$\therefore v = 256 \times 101.6 \text{ cm/s}$$

$$n_2 = \frac{v}{4\ell_2} = \frac{256 \times 101.6}{4 \times 25.6} = 254 \text{ Hz}$$

$$\text{No. of beats/sec} = n_1 - n_2 = 256 - 254 = 2$$

6. (b) P.E. = $\int_{R_0}^R \frac{GMm}{r^2} dr = -GMm \left[\frac{1}{R} - \frac{1}{R_0} \right]$

The K.E. acquired by the body at the surface

$$= \frac{1}{2}mv^2$$

$$\therefore \frac{1}{2}mv^2 = -GMm \left[\frac{1}{R} - \frac{1}{R_0} \right]$$

$$v = \sqrt{2GM \left(\frac{1}{R_0} - \frac{1}{R} \right)}$$

7. (b) $V_i = 0, V_f = V_{\max}$

$$\Delta V = \text{area under the curve} = 10 \times \frac{11}{2} = 55$$

$$\text{or } V_f - V_i = 55 \text{ m/s} \quad \text{since } V_i = 0$$

$$V_f = 55 \text{ m/s}$$

$$V_f = V_{\max} = 55 \text{ m/s}$$

8. (a) Velocity of water from hole

$$A = v_1 = \sqrt{2gh}$$

Velocity of water from hole B

$$= v_2 = \sqrt{2g(H_0 - h)}$$

Time of reaching the ground from hole B

$$= t_1 = \sqrt{2(H_0 - h)/g}$$

Time of reaching the ground from hole A

$$= t_2 = \sqrt{2h/g}$$

9. (b) At a height h above the surface of earth the gravitational potential energy of the particle of mass m is

$$U_h = -\frac{GM_em}{R_e + h}$$

Where M_e & R_e are the mass & radius of earth respectively.

In this question, since $h = R_e$

$$\text{So } U_{h=R_e} = -\frac{GM_em}{2R_e} = \frac{-mgR_e}{2}$$

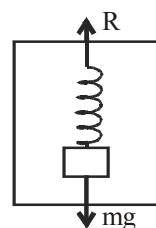
10. (b) $\therefore \theta_1 < \theta_2 \Rightarrow \tan \theta_1 < \tan \theta_2$

$$\Rightarrow \left(\frac{V}{T} \right)_1 < \left(\frac{V}{T} \right)_2$$

$$\text{from } PV = \mu RT; \frac{V}{T} \propto \frac{1}{P}$$

$$\text{Hence } \left(\frac{1}{P} \right)_1 < \left(\frac{1}{P} \right)_2 \Rightarrow P_1 > P_2$$

11. (a) Let acceleration of lift = a and let reaction at spring balance = R



Applying Newton's law

$$R - mg = ma \Rightarrow R = m(g + a)$$

thus net weight increases, so reading of spring balance increases.

12. (d) $Y = 2\eta(1 + \sigma) \Rightarrow \sigma = \frac{0.5Y - \eta}{\eta}$

13. (b) $y = 2 \sin\left(\frac{\pi t}{2} + \phi\right)$

velocity of particle $\frac{dy}{dt} = 2 \times \frac{\pi}{2} \cos\left(\frac{\pi t}{2} + \phi\right)$

acceleration $\frac{d^2y}{dt^2} = -\frac{\pi^2}{2} \sin\left(\frac{\pi t}{2} + \phi\right)$

Thus $a_{\max} = \frac{\pi^2}{2}$

14. (b) Change in internal energy do not depend upon the path followed by the process. It only depends on initial and final states i.e.,

$$\Delta U_1 = \Delta U_2$$

15. (d) As $E = \frac{p^2}{2m}$

$$\therefore \frac{dE}{E} = 2 \left(\frac{dp}{p} \right) = 2 \times 5\% = 10\%$$

16. (a) $\gamma = \alpha_1 + \alpha_2 + \alpha_3$

$$= 13 \times 10^{-7} + 231 \times 10^{-7} + 231 \times 10^{-7}$$

$$= 475 \times 10^{-7}$$

17. (b) $\omega = \frac{2\pi}{0.01}$ and $k = \frac{2\pi}{0.30}$

$$v = \frac{\omega}{k} = \frac{2\pi}{0.01} \times \frac{0.30}{2\pi} = 30 \text{ m s}^{-1}$$

18. (b) Given, $u_1 = u_2 = u$, $\theta_1 = 60^\circ$, $\theta_2 = 30^\circ$

In Ist case, we know that range

$$R_1 = \frac{u^2 \sin 2(60^\circ)}{g} = \frac{u^2 \sin 120^\circ}{g} = \frac{u^2 \sin(90^\circ + 30^\circ)}{g}$$

$$= \frac{u^2 (\cos 30^\circ)}{g} = \frac{\sqrt{3} u^2}{2g}$$

In IInd case when $\theta_2 = 30^\circ$, then

$$R_2 = \frac{u^2 \sin 60^\circ}{g} = \frac{u^2 \sqrt{3}}{2g} \Rightarrow R_1 = R_2$$

(we get same value of ranges).

19. (d) As the block moves up with the fall of coil, l decreases, similarly h will also decrease because when the coin is in water, it displaces water equal to its own volume only.

21. (d) Electric displacement vector, $\vec{D} = \epsilon \vec{E}$

As, $\epsilon = \epsilon_0 K$ $\therefore \vec{D} = \epsilon_0 K \vec{E}$

22. (d)

$$Q = \frac{\text{Potential drop across capacitor or inductor}}{\text{Potential drop across R.}}$$

$$= \frac{\omega L}{R}$$

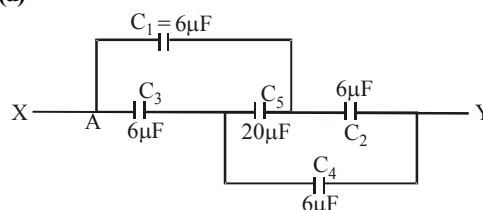
23. (b) For minimum deviation, incident angle is equal to emerging angle.

\therefore QR is horizontal.

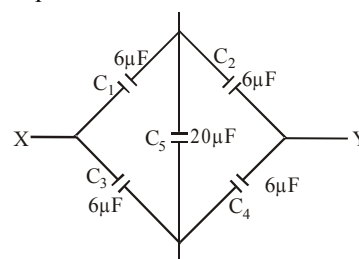
24. (c) Sky wave propagation is not possible for frequency > 30 MHz because they are not reflected by ionosphere.

25. (a) Conservation of energy requires that the 15.0 eV photon energy first provides the ionization energy to unbind the electron, and then allows any excess energy to become the electron's kinetic energy. The kinetic energy in this case is $15.0 \text{ eV} - 13.6 \text{ eV} = 1.4 \text{ eV}$.

27. (d)

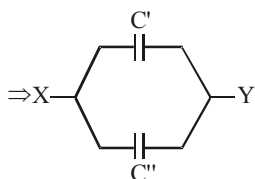
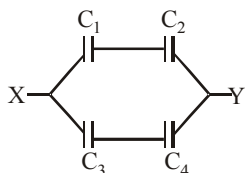


Equivalent circuit



As $\frac{C_1}{C_3} = \frac{C_2}{C_4}$

Hence no charge will flow through $20\mu\text{F}$



C_1 and C_2 are in series, also C_3 and C_4 are in series.

Hence $C' = 3\mu\text{F}$, $C'' = 3\mu\text{F}$

C' and C'' are in parallel hence net capacitance

$$= C' + C'' = 3 + 3 = 6\mu\text{F}$$

29. (a) Einstein equation $E = h\nu_0 + \text{K.E}$
where E = energy of incident photon.

$h\nu_0$ = work function of metal

K.E = max. kinetic energy of e^-

$$\therefore 4\text{ eV} = 2\text{ eV} + \text{K.E} \quad \text{or} \quad \text{K.E} = 2\text{ eV}$$

Stopping potential is the potential difference which may stop this e^- .

Let it be V , then $eV = 2e \Rightarrow V = 2\text{ volt}$.

30. (c) β -rays are the beam of fast moving electrons.

31. (b) $\phi = 10t^2 - 50t + 250$

$$e = -\frac{d\phi}{dt} = -(20t - 50)$$

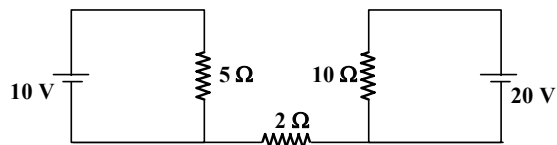
$$e_{t=3} = -10\text{ V}$$

32. (c) $B_{\text{axis}} = \left(\frac{\mu_0 NI}{2x^3} \right) R^2$

$$B \propto R^2$$

So, when radius is doubled, magnetic field becomes four times.

33. (a) The current in 2Ω resistor will be zero because it is not a part of any closed loop.



34. (a) As $\beta \propto \lambda$

\therefore fringe width becomes $\frac{5}{4}$ times,

$$\text{No. of fringes} = \frac{4}{5} \times 10 = 8$$

35. (c) $\frac{dN}{dt} = n - \lambda N$

$$dN = (n - \lambda N)dt$$

$$\int_{N_0}^N \frac{dN}{n - \lambda N} = \int_0^t dt \Rightarrow -\frac{1}{\lambda} \int_{N_0}^N \frac{-\lambda dN}{n - \lambda N} = t$$

$$\Rightarrow -\frac{1}{\lambda} [\log_e (n - \lambda N)]_{N_0}^N = t$$

$$\Rightarrow -\frac{1}{\lambda} \left[\log_e \left(\frac{n - \lambda N}{n - \lambda N_0} \right) \right] = t$$

$$\Rightarrow \lambda t = \left[\log_e \left(\frac{n - \lambda N_0}{n - \lambda N} \right) \right]$$

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

$$n - \lambda N = (n - \lambda N_0) e^{-\lambda t}$$

$$\frac{n}{\lambda} - \left(\frac{n}{\lambda} - N_0 \right) e^{-\lambda t} = N$$

36. (b) The incident angle is 45° incident angle > critical angle, $i > i_c$

$$\therefore \sin i > \sin i_c \quad \text{or} \quad \sin 45 > \sin i_c$$

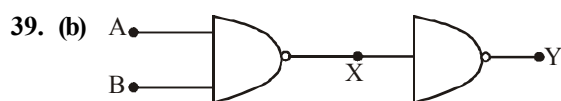
$$\sin i_c = \frac{1}{n}$$

$$\therefore \sin 45^\circ > \frac{1}{n} \quad \text{or} \quad \frac{1}{\sqrt{2}} > \frac{1}{n} \Rightarrow n > \sqrt{2}$$

37. (c) Neutral temperature,

$$\theta_n = \frac{\theta_i + \theta_0}{2} = \frac{530 + 10}{2} = 270^\circ \text{C}.$$

38. (d) Option (d) is false because the reason why the voltage leads the current is because $\frac{1}{C\omega} > L\omega$ and if the voltage lags, the inductive reactance is greater than the capacitive reactance.



$$X = \overline{AB}$$

$$\therefore Y = \overline{X} = \overline{\overline{AB}}$$

$Y = AB$ by Demorgan theorem

\therefore This diagram performs the function of AND gate.

41. (b) At the middle point velocity of the particle under SHM is maximum but acceleration is zero since displacement is zero. So Assertion is true.

We know that $x = a \sin \omega t \dots (1)$

Where x is displacement and a is amplitude.

$$\text{Velocity} = \frac{dx}{dt} = a\omega \cos \omega t$$

$$= a\omega \cos(-\omega t) = a\omega \sin\left(\frac{\pi}{2} - (-\omega t)\right)$$

$$= a\omega \sin\left(\omega t + \frac{\pi}{2}\right) \dots (2)$$

From equation (i) and (ii) it is clear that

Velocity is ahead of displacement (x) by $\frac{\pi}{2}$ angle.

42. (a) Lenz's law (that the direction of induced emf is always such as to oppose the change that cause it) is direct consequence of the law of conservation of energy.

43. (c) The susceptibility of ferromagnetic substance decreases with the rise of temperature in a complicated manner. After Curies point in the susceptibility of ferromagnetic substance varies inversely with its absolute temperature. Ferromagnetic substance obey's Curie's law only above its Curie point.

44. (a) For a disc rolling without slipping on a horizontal rough surface with uniform angular velocity, the acceleration of lowest point of disc is directed vertically upwards and is not zero (Due to translation part of rolling, acceleration of lowest point is zero. Due to rotational part of rolling, the tangential acceleration of lowest point is zero and centripetal acceleration is non-zero and upwards). Hence Assertion is false.

46. (d) Two equipotential surfaces are not necessarily parallel to each other.

48. (a) Ozone layer in the stratosphere helps in protecting life of organism from ultraviolet radiation on earth. Ozone layer is depleted due to of several factors like use of chlorofluoro carbon (CFC) which is the cause of environmental damages.

49. (a) The mean free path of a gas molecule is the average distance between two successive collisions. It is represented by λ .

$$\lambda = \frac{1}{\sqrt{2}} \frac{kT}{\pi \sigma^2 P} \text{ and } \lambda = \frac{m}{\sqrt{2} \cdot \pi \sigma^2 d}$$

Here, σ = diameter of molecule and

k = Boltzmann's constant.

$$\Rightarrow \lambda \propto 1/d, \lambda \propto T \text{ and } \lambda \propto 1/P.$$

Hence, mean free path varies inversely as density of the gas. It can easily proved that the mean free path varies directly as the temperature and inversely as the pressure of the gas.

50. (a) The force acting on the body of mass M are its weight Mg acting vertically downward and air resistance F acting vertically upward.

$$\therefore \text{Acceleration of the body, } a = g - \frac{F}{M}$$

Now $M > m$, therefore, the body with larger mass will have great acceleration and it will reach the ground first.

52. (d) Reason is true, Assertion is false. In doppler for sound wave effect due to observer and source motion are different.

53. (a) Power loss $= i^2 R = \left(\frac{P}{V}\right)^2 R$

[P = Transmitted power]

54. (a) de-Broglie wavelength associated with gas molecules varies as 1

$$\lambda \propto \frac{1}{\sqrt{T}}$$

59. (b) β -particles, being emitted with very high speed compared to α -particles, pass for very little time near the atoms of the medium. So the probability of the atoms being ionised is comparatively less. But due to this reason, their loss of energy is very slow and they can penetrate the medium through a sufficient depth.
60. (c) Heat is carried away from a fire sideways mainly by radiations. Above the fire, heat is carried by both radiation and by convection of air. The latter process carries much more heat.

CHEMISTRY

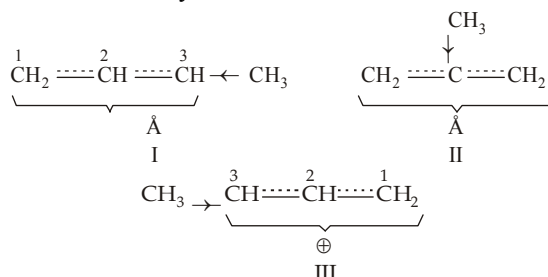
61. (c) $K_{sp} = 4S^3 = 3.2 \times 10^{-11} \therefore S = 2 \times 10^{-4} \text{ M}$

$$[\text{OH}^-] = 2S = 2 \times 2 \times 10^{-4} \text{ M}$$

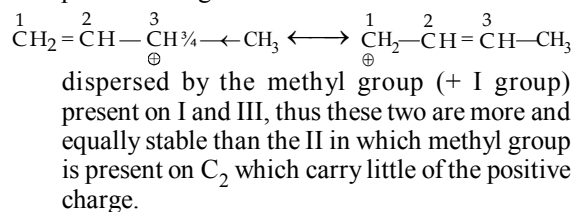
$$\therefore \text{pH} = 14 - \text{pOH}$$

$$= 14 + \log 4 \times 10^{-4} = 10.60$$

62. (c) Let us first write the resonance hybrid of the three allyl carbonium ions.



We know that better the dispersal of + charge, more will be the stability of the carbonium ion. Further, we know that C_1 and C_3 carry most of the positive charge which is



63. (a) Since the sol particles migrate towards cathode, they are positively charged. Hence, anions would be effective in coagulation. Greater is the valence of effective ion, smaller will be its coagulating value.
64. (a) ($\text{Na}_2\text{O}_2 + \text{HCl}$) is commercially known as oxone and is used for bleaching of delicate fibres.
65. (d) In the given complex we have two bidentate ligands (i.e. en and C_2O_4), so coordination number of E is 6

$$(2 \times 2 + 1 \times 2 = 6)$$

Let the oxidation state of E in complex be x , then

$$[x + (-2) = 1] \text{ or } x - 2 = 1$$

or $x = +3$, so its oxidation state is +3

Thus option (d) is correct.

68. (b) Rate of diffusion $\propto \sqrt{\frac{1}{\text{Molecular mass}}}$

\therefore Molecular mass of $\text{HCl} >$ Molecular mass of NH_3

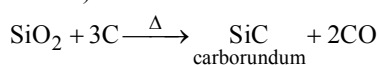
\therefore HCl diffuses at slower rate and white ammonium chloride is first formed near HCl bottle.

69. (a) $(n + l)$ rule the higher the value of $(n + l)$, the higher is the energy. When $(n + l)$ value is the same see value of n .

	I	II	III	IV
$(n + l)$	$(4 + 1)$	$(4 + 0)$	$(3 + 2)$	$(3 + 1)$
	5	4	5	4

$\therefore IV < II < III < I$

71. (a) Silica on heating with carbon at elevated temperature, gives carborundum (silicon carbide)

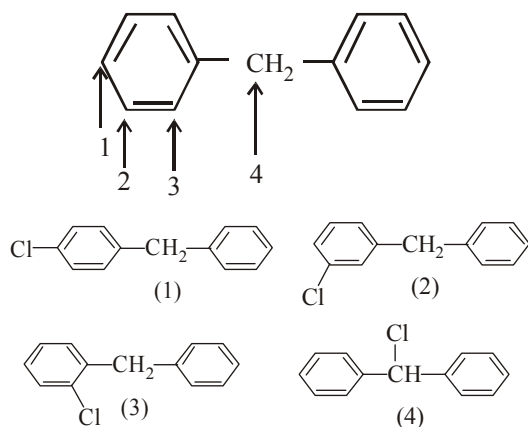


Carborundum is a very hard substance.

72. (c) When non-terminal alkynes are heated with NaNH_2 in an inert solvent, the triple bond migrates to the end carbon atom.

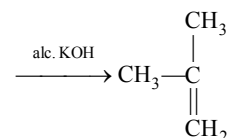
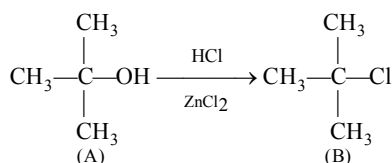
73. (b) For each central atom there are two tetrahedral voids in AgI crystal. The number of Ag^+ ion is equal to number of I^- ion. It means only 50% of the void will be occupied by Ag^+ ion.

74. (b) In diphenylmethane monochlorination at following positions will produce structured isomers



76. (a) $\text{CH}_3\text{COOH} \xrightarrow[\Delta]{\text{NH}_3} \text{CH}_3\text{CONH}_2$ (A) Ethanamide
 $\xrightarrow{\text{Br}_2/\text{NaOH}} \text{CH}_3\text{NH}_2$ (B) Methanamine
 $\xrightarrow{\text{NaNO}_2/\text{dil. HCl}} \text{CH}_3\text{OH}$ (C) Methanol

77. (a) Reaction involved is given as :



78. (d) 1-pentanol
 Primary alcohols readily form ether when heated with conc. H_2SO_4 .

79. (c) No. of molecules

$$\text{Moles of CO}_2 = \frac{44}{44} = 1 \quad N_A$$

$$\text{Moles of O}_3 = \frac{48}{48} = 1 \quad N_A$$

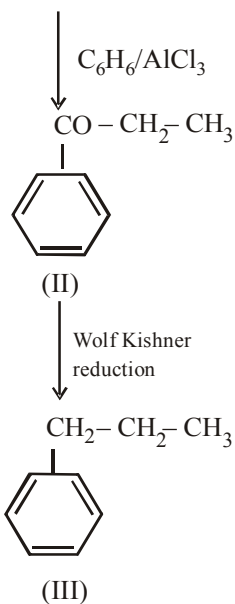
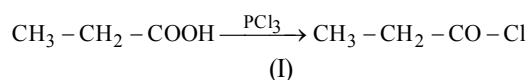
$$\text{Moles of H}_2 = \frac{8}{2} = 4 \quad 4N_A$$

$$\text{Moles of SO}_2 = \frac{64}{64} = 1 \quad N_A$$

80. (b) The more the reduction potential, the more is the deposition of metals at cathode. Cation having E° value less than -0.83 V (reduction potential of H_2O) will not deposit from aqueous solution.

81. (b) CO bond strength is reciprocal to the extent of back donation involved in synergic bonding.

82. (a)



83. (b) Aldol formed in aromatic aldehydes itself loses water molecule without heating because double bond formed is more stable due to conjugation with benzene ring.

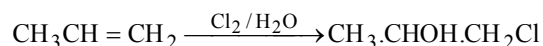
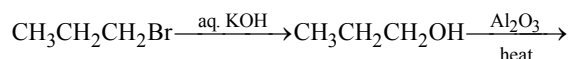
$C_6H_5CH=CHCHO$ is commonly known as cinnamaldehyde.

84. (a) $2H_2O_2(l) \longrightarrow 2H_2O(l) + O_2(g) \Delta H = ?$

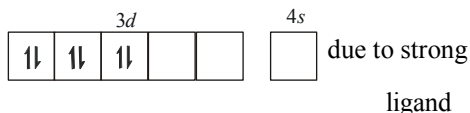
$$\begin{aligned}\Delta H &= [2 \times \Delta H_f \text{ of } H_2O(l) + (\Delta H_f \text{ of } O_2) \\ &\quad - (2 \times \Delta H_f \text{ of } H_2O_2(l))] \\ &= [(2 \times -286) + (0) - (2 \times -188)] \\ &= [-572 + 376] = -196 \text{ kJ/mole}\end{aligned}$$

85. (c) Reaction (c) is endothermic. Electrolysis or decomposition of H_2O is endothermic in nature.

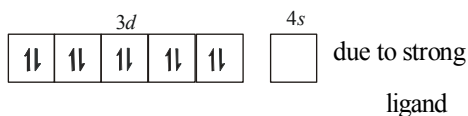
86. (b)



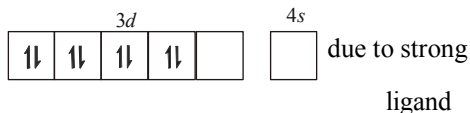
87. (d) Fe^{2+} has electronic configuration



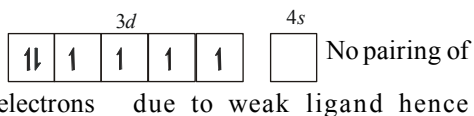
Ni has electronic configuration



Ni^{2+} has electronic configuration



Co^{3+} has electronic configuration

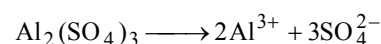


$[CoF_6]^{3-}$ is paramagnetic.

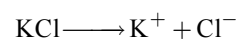
88. (a) Depression in freezing point \propto No. of particles.

(when concentration of different solutions is equal)

$Al_2(SO_4)_3$ provides five ions on ionisation



while KCl provides two ions



$C_6H_{12}O_6$ and $C_{12}H_{22}O_{11}$ are not ionised so they have single particle in solution.

Hence, $Al_2(SO_4)_3$ have maximum value of depression in freezing point or lowest freezing point.

89. (c) Series limit is the last line of the series, i.e. $n_2 = \infty$.

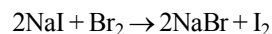
$$\therefore \bar{\nu} = \frac{1}{\lambda} = R \left[\frac{1}{n_1^2} - \frac{1}{n_2^2} \right] = R \left[\frac{1}{n_1^2} - \frac{1}{\infty^2} \right] = \frac{R}{n_1^2}$$

$$\therefore \bar{\nu} = 12186.3 = \frac{109677.76}{n_1^2}$$

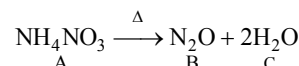
$$\Rightarrow n_1^2 = \frac{109677.76}{12186.3} = 9 \Rightarrow n_1 = 3$$

\therefore The line belongs to Paschen series.

91. (c) Br_2 reacts with NaI only to get I_2 .



92. (a) Reaction involved is :



Hence option (a) is correct.

93. (a) Molar concentration of area = $\frac{10}{60}$ per dm^3

Molar concentration of volatile solute solution

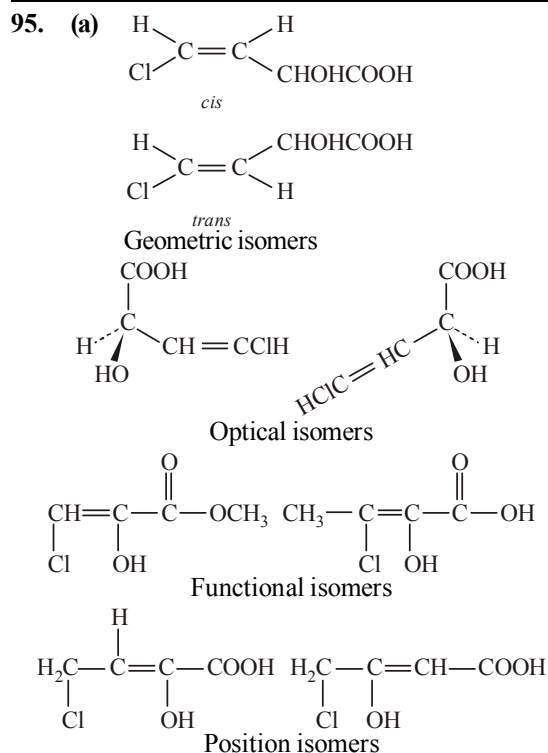
$$= \frac{5}{M} \text{ per } 100 \text{ ml. or, } \frac{50}{M} \text{ per } dm^3$$

For solution of same concentration

or, isotonic solution at same temperature

$$\frac{10}{60} = \frac{50}{M} \text{ or, } M = 300 \text{ g mol}^{-1}$$

94. (a) O.N. of Mn in MnO_4^- is +7 and in Mn^{2+} it is +2. The difference is of 5 electrons.



96. (d) $\sigma_b^2 \sigma_a^{*2} \sigma_b^2 \sigma_a^{*2} (\pi_b^2 = \pi_b^2) \sigma_b^1 (N_2^+ = 13 \text{ electrons})$

97. (d) CO_2 has highest critical temperature of 304.2 K

99. (b) For first order reaction,

$$\text{Rate} = kA_0' = \frac{0.693}{t_{1/2}} \cdot A_0$$

$$\text{For zero order reaction, Rate} = kA_0^0 = \frac{A_0}{2t_{1/2}}$$

$$\text{Ratio in rates} = 2 \times 0.693$$

100. (c) The Friedel-Crafts alkylation reaction will give propyl phenyl ketone which further on Clemmensen's reduction will give butyl benzene

101. (c) LiCl is a covalent compound. Due to the large size of the anion (Cl^-) its effective nuclear charge lessens and its valence shell is held less tightly towards its nucleus. Here, assertion is correct but reason is incorrect.

102. (c) Assertion is true but reason is false. NH_4Cl suppresses the ionisation of NH_4OH due to common ion effect and so ions of third group get precipitated as their hydroxides.

103. (d) The specific conductivity decreases while equivalent and molar conductivities increase with dilution.

104. (a) At cathode : $\text{Cu}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Cu}(\text{s})$
(Reduction)

At anode : $\text{Cu}(\text{s}) \rightarrow \text{Cu}^{2+}(\text{aq}) + 2\text{e}^-$
(Oxidation)

105. (c) It is correct that sodium phenoxide (sodium salt of phenol) and CO_2 on heating form sodium salicylate. This is known as Kolbe's reaction. Ethanol does not respond to this reaction. Therefore, assertion is true. But the reason that phenoxide ion is more basic than ethoxide ion is not correct.

106. (d) Both assertion and reason are false.

HOF bond angle in HFO is lesser than that of HOCl bond angle in HClO. Oxygen is more electronegative than all halogens except fluorine.

107. (c) Plus and minus signs of spin quantum numbers imply that spin angular momentum of the electron, a vector quantity, acts in the same or opposite directions of orbital angular momentum.

108. (a) All magnetically ordered solids (ferromagnetic, ferrimagnetic and antiferromagnetic solids) transform to the paramagnetic state at high temperature due to the randomisation of spins.

109. (c) The assertion that trans-2 butene reacts with Br_2 to product meso-2, 3-dibromobutane is correct but it does not involve syn-addition of Br_2 .

110. (c) Assertion is true because lower oxidation state becomes more & more stable for heavier elements in p-block due to inert pair effect. Hence Reason is false.

111. (a) Both assertion and reason are true and reason is the correct explanation of assertion.

Considering the attractive force pressure in ideal gas equation ($PV = nRT$) is corrected

by introducing a factor of $\frac{an^2}{V^2}$ where a is

van der Waals constant.

112. (c) $(4n + 2)\pi$ electrons and planar structure are the essential conditions for aromaticity.
113. (c) *Assertion is true but reason is false.*
 $\Delta H = \Delta E + n_g RT$
 $\Delta n_g = (1 + 3) - 2 \quad \Delta H > \Delta E.$
 If the value of Δn_g is less than one then $\Delta H < \Delta E$.
114. (a) **R** is the correct explanation of **A**.
115. (a) *Both assertion and reason are true and reason is the correct explanation of assertion.*
 Antioxidants are the compounds that retard the action of oxygen on the food and thereby help its preservation.
116. (a) Reason is the correct explanation of Assertion.
117. (d)
118. (c) Assertion is correct. Reason is incorrect.
119. (a) *Both assertion and reason are true and reason is the correct explanation of assertion.*
 Benzaldehyde is less reactive than ethanol towards nucleophilic attack. The combined effect of $-I$ and $+R$ effect of phenyl group is electron donating which increases the electron density on the carbon atom of the $>C=O$ in benzaldehyde.
120. (a) *Both assertion and reason are true and reason is the correct explanation of assertion.*
124. (b) Sucrose is classified under non-reducing sugar because it does not have any free aldehyde or keto group.
125. (c) Acetyl CoA is common to respiration mediated breakdown of fats, carbohydrates and proteins. Fats are broken down to fatty acid and glycerol and again fatty acid degraded to acetyl Co - A . Protein first degraded by proteases to individual amino acids which deaminated to pyruvic acid and further decarboxylised to acetyl Co- A.
127. (c) The concentration of substrate at which velocity of enzymatic action reaches half of its maximum value, is called **K_m** value or **Michaelis constant**.
128. (a) Onion - Bulb - Underground stem , Ginger - Rhizome, *Chlamydomonas* - Zoospore, Yeast - Ascospores
130. (a) CO_2 from the respiratory tissues to the lungs is transported by the blood in 3 ways:
(i) In dissolved state or as a physical solution: Very small amount physically dissolved in plasma (7% i.e. @ 0.3 ml of CO_2 by each 100 ml of blood).
(ii) Bicarbonate ions: @ 70% (i.e. @ 2.5 ml per 100 ml of blood) CO_2 diffuses in plasma & then into RBCs where it (in the presence of carbonic anhydrase) combines with H_2O to form carbonic acid which is almost spontaneously dissociated into hydrogen ion and bicarbonate ions.
(iii) Carbaminohaemoglobin : @ 23% (i.e. @ 1 ml of CO_2 per 100 ml of blood) combines with haemoglobin forming an unstable compound.

BIOLOGY

121. (d) Sclerenchyma consists of long, narrow cells with thick and lignified cell walls having a few or numerous pits. They are usually dead and without protoplasts.
123. (d) Order being higher category is the assemblage of families which exhibit a few similar characteristics.
 Dog (*Canis familiaris*) and Cat (*Felis domesticus*) belong to two different families—Carnivore and Felidae respectively.
131. (c) Imbibition is the process of adsorption of water by hydrophilic surfaces of a substance without forming a solution. It is a type of diffusion by which movement of water takes place along a diffusion gradient. The solid particles which adsorb water or any other liquid are called Imbibants. The liquid which is imbibed is known as Imbibate. Examples are absorption of water by seeds and dry wood.

132. (c) Synthesis of estrogen and progesterone due to high level of hCG is a normal gonadotropic activity in a normal pregnant female.
133. (b) Number of chromosome in root cells of wheat plant is
 $2n = 42$
 $n = \frac{42}{2} = 21$
The number of chromosome in the cell of pollen grain is 21 because pollen grains are haploid (n) in nature.
134. (a) Synthesis of RNA exhibits several features that are synonymous with DNA replication. RNA synthesis requires accurate and efficient initiation, elongation proceeds in the 5'-3' direction (*i.e.* the polymerase moves along the template strand of DNA in the 3'-5' direction), and RNA synthesis requires distinct and accurate termination. Transcription exhibits several features that are distinct from replication.
135. (c) Organs which have a common fundamental anatomical plan and similar embryonic origin whatever varied functions they may perform are regarded as homologous organs. For examples the flippers of a whale, a bat's wing, fore-limb of a horse, a bird's wing and forelimbs of human are structurally as well as functionally different.
136. (b) Adipose tissue is another type of connective tissue located mainly beneath the skin. The cells of this tissue are specialised to store fats.
138. (a) Diploblastic animals have two germinal layers, outer ectoderm and inner endoderm, *e.g.*, Porifera and Coelenterate. Triploblastic animals have three germinal layers – outer ectoderm, middle mesoderm and inner endoderm, *e.g.*, Platyhelminthes, Aschelminthes, Annelida, Arthropoda, Molluscs, Echinodermata and Chordata.
141. (b) Streptokinase is immediately given to dissolve the thrombus carrying myocardial infarction.
142. (d) A gliding joint is a common type of synovial joint formed between bones that meet at flat or nearly flat articular surfaces. Gliding joints allow the bones to glide past one another in any direction along the plane of the joint - up and down, left and right, and diagonally. Many gliding joints are formed in the appendicular skeleton between the carpal bones of the wrist; between the carpals and the metacarpals of the palm; between the tarsal bones of the ankle; and between the tarsals and the metatarsals of the foot.
143. (a) A palindromic sequence is a nucleic acid sequence (DNA or RNA) that is the same whether read 5' (five-prime) to 3' (three prime) on one strand or 5' to 3' on the complementary strand with which it forms a double helix.
5 - GAATTC - 3
3 - CTTAAG - 5
It is a palindromic sequence of DNA cut by restriction enzyme *EcoRI*.
144. (b) During zygotene, a substage of Prophase I of meiosis I, chromosomes start pairing together called synapsis. Such paired chromosomes are called as homologous chromosomes. A complex structure *i.e.*, synaptonemal complex is formed by a pair of synapsed homologous chromosomes called a bivalent or a tetrad.
145. (b) The ELISA is a fundamental tool of clinical immunology, and is used as an initial screen for HIV detection. Based on the principle of antigen- antibody interaction, this test allows for easy visualization of results.

146. (b) Genotype of carrier parents is – Aa (male parent) \times Aa (female parent)

	A	a	
A	AA	Aa	
a	Aa	*aa	

AA \rightarrow normal child (25%)

Aa \rightarrow carriers child (50%)

aa \rightarrow affected child (25%)

147. (c) For every CO₂ molecule entering the Calvin cycle, 3 molecules of ATP and 2 molecules of NADPH are required.

148. (b) At the trophic level of consumers the rate at which food energy is assimilated is called secondary productivity. Rabbit is a consumer.

149. (c) Nagarjunsagar-Srisaïlam Tiger Reserve is the largest Tiger reserve in India and the only Tiger Reserve in Andhra Pradesh state.

150. (a) Magnesium is a constituent of the ring structure of chlorophyll. Function of manganese is to activate many enzymes involved in photosynthesis, respiration and nitrogen metabolism. The best defined function of manganese is in the splitting of water of liberate oxygen during photosynthesis.

151. (a) The gases that makes highest relative contribution to the green house gases are carbon dioxide (CO₂) and methane (CH₄).

152. (a) **Geitonogamy** is the transfer of pollen grains in different flowers of same plant.

153. (c) A hybridization probe is a fragment of DNA of variable length which is used in DNA samples to detect the presence of nucleotide sequence (the DNA target) that are complementary to the sequence in the probe. The probe hybridize to single-stranded DNA whose base sequence allow probe target base-pairing due to complementary between the probe and target.

154. (a) Physiological value of carbohydrates is 4.0 kcal/g, proteins 4.0 kcal/g and of fats is 9.0 kcal/g. Hence,

5 g raw sugar will yield

$$5 \times 4.0 = 20.0 \text{ kcal}$$

4 g albumin (protein) will yield

$$4 \times 4.0 = 16.0 \text{ kcal}$$

10 + 2 g of fat will yield

$$12 \times 9.0 = 108.0 \text{ kcal}$$

Total yield = 144 kcal.

155. (b) For a gene with two alleles, *A* (dominant) and *a* (recessive), if the frequency of *A* is *p* and the frequency of *a* is *q*, then the the frequencies of the three possible genotypes (*AA*, *Aa*, and *aa*) can be expressed by the Hardy-Weinberg equation :

$$p^2 + 2pq + q^2 = 1$$

Where p^2 = frequency of *AA* (homozygous dominant) individuals, $2pq$ = frequency of *Aa* (heterozygous) individuals and q^2 = frequency of *aa* (homozygous recessive) individuals. The equation can be used to calculate allele frequencies if the numbers of homozygous recessive individuals in the population is known.

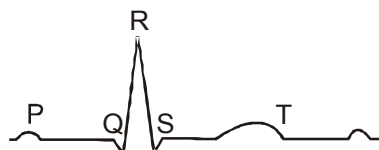
Here, $p = 0.7$ and $q = 0.3$ (given)

$\therefore 2pq$ (frequency of heterozygote)

$$= 2 \times 0.7 \times 0.3 = 0.42$$

156. (c) The figure shows the tubectomy. This is a surgical method to prevent pregnancy in women. In tubectomy small part of the fallopian tube is removed or tied through a small cut in the abdomen or through vagina. It is very effective method but reversibility is very poor.

157. (d)



The P-wave represents the electrical **excitation (or depolarisation) of the atria**, which leads to the contraction of both the atria. The QRS complex represents the **depolarisation of the ventricles**, which initiates the ventricular contraction. The contraction starts shortly after Q and marks the beginning of the systole.

158. (b) Mortality or Death rate refers to the death of individuals in a population.

$$\begin{aligned}\text{Death rate} &= \frac{\text{No. of deaths}}{\text{Total population}} \\ &= \frac{4}{40} = 0.1 \text{ individuals per fruitfly} \\ &\quad \text{per week}\end{aligned}$$

159. (a) Gene therapy is an experimental technique that uses genes to treat or prevent disease. The first clinical gene therapy was given for treating adenosine deaminase deficiency. A four-year old girl became the first gene therapy patient on September 14, 1990 at the NIH Clinical Center. Adenosine deaminase deficiency, also called ADA deficiency or ADA-SCID is an autosomal recessive metabolic disorder that causes immunodeficiency. ADA deficiency is due to a lack of the enzyme adenosine deaminase.
160. (d) Molecule (A) represents structure of morphine. Morphine is the most abundant alkaloid found in *Opium*, the dried sap (latex) derived from shallowly slicing the unripe seedpods of the *Opium*, or common and/or edible, poppy *Papaver somniferum*. Morphine is a potent opiate analgesic drug that is used to relieve severe pain.
161. (a) A category is a rank or level in the hierarchical classification of organisms. Taxon is a unit in classification which may represent any level of grouping of organisms based on certain common characteristics. There is some confusion in the use of taxon and category, for example Bryophyta is a taxon while division is a category.

162. (c) Due to deficiency of sulphur plant shows chlorosis (*i.e.*, yellowing due to degradation of chlorophyll) followed by anthocyanin development. The younger leaves show chlorosis before older ones. Sulphur is not the constituent of chlorophyll. The main constituent of chlorophyll is magnesium.

163. (a) The blood urea level rises abnormally (uremia) in patients suffering from renal failures. In uremia patients an artificial kidney is used for removing accumulated waste products like urea from the blood by a process called hemodialysis. In this way, hemodialysis saves and prolongs the life of many uremic patients.

165. (b) Activation energy is an external supply of energy which is needed for the initiation of the chemical reaction. Activation energy required for such a large number of reactions cannot be provided by living systems. Enzymes lower the activation energy required for a reaction. Enzymes are generally specific for their substrates.

166. (c) Head of a sperm has acrosome but the spiral row of mitochondria are present in the mid (connecting) piece of the sperm.

168. (a) F₂ phenotypic and genotypic ratio in monohybrid cross involving incomplete dominance is

1	:	2	:	1
RR		Rr		rr
(red)		(pink)		(white)

169. (b) Besides cereals, green vegetables, brewer's yeast, egg white, vitamin B₂ is also produced by intestinal bacteria. The vitamin was first obtained in 1938 using wild strain of mould *Ashbhya gossypii*. Vitamin B₂ is essential for normal growth and reproduction in a number of laboratory animals.
170. (b) Sponges belong to Porifera and they have characteristic canal system.
171. (c) The use of condoms has been shown to decrease the transmission of AIDS because condoms is contraceptive.

- 172. (a)** Glycolysis occurs in cytoplasm as all necessary enzymes are found in it. This process is common in aerobic/anaerobic respiration. In this process, one glucose molecule is converted into 2 molecules of pyruvic acid.
- 174. (c)** Intra-uterine device (IUD) Copper-T is plastic or metal object placed in the uterus by a doctor. Copper-T prevent the fertilization of the egg or implantation of the embryo.
- 176. (c)** Males have more stature than females because of the action of male sex hormone-testosterone which is secreted by testis in males. Body starts secreting testosterone from the age of puberty. Its secretion is under the influence of Luteinizing Hormone (LH) of the anterior lobe of pituitary gland. Testosterone controls the development of secondary sexual characters in males like hoarseness of voice, development of facial hairs, bone growth, calcium retention, closing of epiphysial cartilage. The total quantity of bone matrix increases. The pelvic outlet is narrowed and lengthened. The strength of the pelvic bones increases to carry more loads. That is why males have more stature than females after puberty when this hormone is present in the blood.
- hCG (Human Chorionic Gonadotropin) is the hormone secreted by human placenta during pregnancy. hCG enlarges the corpus luteum in the mother's ovary and stimulates it to secrete progesterone.
- 177. (a)** Transformation does not involve passive entry of DNA molecules through permeable cell walls and membranes. It does not occur 'naturally' in all species of bacteria, only in those species possessing the enzymatic machinery involved in the active uptake and recombination processes. Even in these species, all cells in a given population are not capable of active uptake of DNA. Only competent cells, which possess a so called competence factor are capable of serving as recipients in transformation.
- 179. (a)** A sanctuary is an area which is reserved for the protection of wild animals only. The activities like harvesting of timber, collection of minor forest products and private ownership rights are allowed, however, such activities should not have any adverse effect on animals.
- 180. (c)** Interferons are proteins that are effective against most viruses. They are naturally produced by virus infected cells. The proteins interact with adjacent cells and make them resistant to virus attack. Now interferons are also being manufactured through genetic engineering.
- Interferons control the multiplication of virus particles by inhibiting their protein synthesis.

GENERAL KNOWLEDGE

- 181. (b)** Light emitting diode < CFL tube < fluorescent tube < incandescent bulb.
- 183. (a)** The black part of the moon is called sea of tranquility.
- 184. (b)** Maqbool Fida Hussain, described as the Picasso of India, was one of the subcontinent's best known painters. His influence on contemporary South Asian art was enormous. In 1955 he was awarded the prestigious Padma Shri by the Indian government and in the 1980s was nominated to the upper house of the Indian parliament, while in 1971 he was invited, with Pablo Picasso, to the Sao Paulo Biennial in Brazil.
- 185. (a)** At magnetic equator, $R = H$; $V = 0$.
- 187. (a)** In the photoelectric effect, electrons are emitted from solids, liquids or gases when they absorb energy from light. Electrons emitted in this manner may be called photoelectrons.
- 188. (c)** Candles contain a mixture of paraffin wax and stearic acid.

- 189. (c)** Alum is used for all the double sulphates having the composition $M_2SO_4 \cdot M_2(SO_4)_3 \cdot 24H_2O$. Where M stands for monovalent basic radicals. Alums have Germicide properties and thus used in purification of water.
- 191. (b)** Barmako is the capital of Mali.
- 192. (c)** The first major attempt in curriculum reconstruction in India was made in 1937 when Gandhiji propounded the idea of Basic Education.
- 194. (c)** Register memory is faster . Register is an integral part of the CPU chip .Thereby fetching data is faster. Cache on the other hand is a seperate memory unit
- 199. (b)** Splenic fever is another name of *Anthrax* which is an acute disease caused by the bacterium *Bacillus anthracis*. Most forms of the disease are lethal, and it affects both humans and animals.