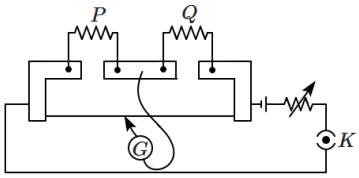
# Physics

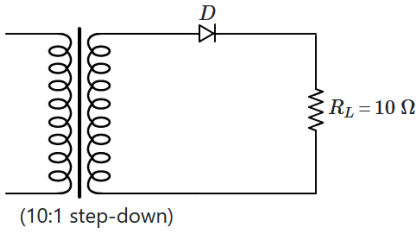
**1.** In a metre bridge arrangement the resistances in the gaps $P, Q$ differ by $100\,\Omega$ and the balance length measured from the left, is 25 cm (total length = 100 cm ).

The unknown resistance $Q$ is given by:




| | | | |
|---|---|---|---|
| 1. | 50 Ω | 2. | 100 Ω |
| 3. | 150 Ω | 4. | 400 Ω |

**2.** A 10 : 1 step-down transformer has an ideal diode and a 10 Ω resistance connected to its secondary circuit while 220 V AC mains is applied to the primary.




Assuming the transformer to be ideal, the current in the primary circuit when the diode is reverse-biased is:

| | | | |
|---|---|---|---|
| 1. | 0.22 A | 2. | $\frac{0.22}{\sqrt{2}}$ A |
| 3. | $0.22\sqrt{2}$ A | 4. | zero |

**3.** The threshold frequency of a metal is $10^{15}$ Hz. When light with a wavelength $\lambda = 4000\ \mathring{A}$ is incident on its surface, which of the following statements is correct?

| | |
|---|---|
| 1. | No photoelectric emission occurs. |
| 2. | Photoelectrons are emitted with zero velocity. |
| 3. | Photoelectrons are emitted at a speed of $10^3$ m/s. |
| 4. | Photoelectrons are emitted at a speed of $10^5$ m/s. |

**4.** As shown below, standing waves are formed in an open organ pipe (Figure-a ) and a closed organ pipe (Figure-b ). Which harmonic numbers are represented in each case?

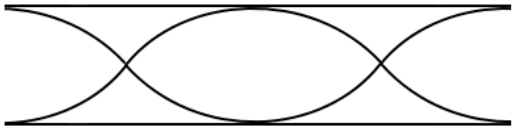


Figure - a

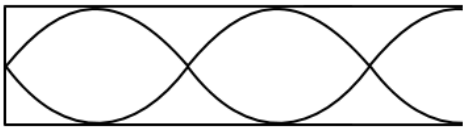


Figure - b

| | | | |
|---|---|---|---|
| 1. | $2^{nd}, 3^{rd}$ harmonics | 2. | $3^{rd}, 3^{rd}$ harmonics |
| 3. | $2^{nd}, 5^{th}$ harmonics | 4. | $3^{rd}, 5^{th}$ harmonics |

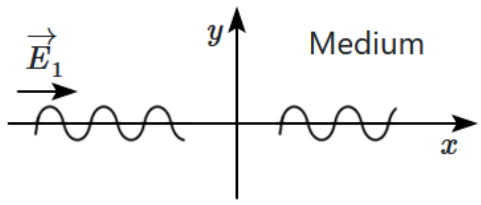
**5.** A metal wire with length $L$, cross-sectional area $A$, and Young's modulus $Y$ is stretched by a variable force $F$ such that $F$ is always slightly greater than the elastic resistance forces in the wire. When the elongation of the wire is $l$, the following statements hold:

| | |
|---|---|
| **(A)** | The work done by $F$ is $\frac{YAl^2}{2L}$. |
| **(B)** | The work done by $F$ is $\frac{YAl^2}{L}$. |
| **(C)** | The elastic potential energy stored in the wire is $\frac{YAl^2}{2L}$. |
| **(D)** | No heat is produced during the elongation. |

Choose the correct option from the options given below:

| | |
|---|---|
| 1. | **(A), (B)** and **(C)** only |
| 2. | **(A)** and **(B)** only |
| 3. | **(B)** and **(D)** only |
| 4. | **(A), (C)** and **(D)** only |

**6.** The region on the left of the $y$-axis $(x < 0)$ represents vacuum, and the region on the right $(x > 0)$ represents a transparent medium. An electromagnetic wave travelling along the $x$-axis given by:
$\vec{E}_1(x,t) = E_1\hat{j}\ \sin(\omega t - k_0 x)$, where $x < 0$,
is incident on to the medium on the right. The transmitted wave in the medium is:
$\vec{E}_2(x,t) = E_2\hat{j}\ \sin(\omega t - 2k_0 x)$, where $x > 0$.
The refractive index of the medium is:




| | | | |
|---|---|---|---|
| 1. | 2 | 2. | $\sqrt{2}$ |
| 3. | 4 | 4. | $2\sqrt{2}$ |

**7.** A small permanent magnet is placed 'antiparallel' to a uniform magnetic field $B$. A null point is found at a distance $r$, on the axis of the magnet. Then, $r$ is proportional to (nearly):

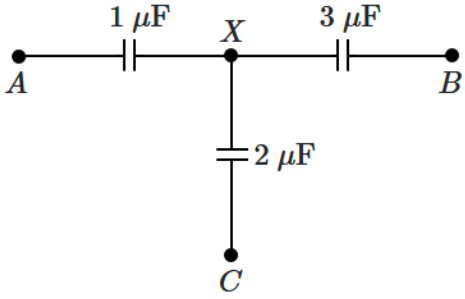
| | | | |
|---|---|---|---|
| 1. | $B^{-3}$ | 2. | $B^{-2}$ |
| 3. | $B^{-1/2}$ | 4. | $B^{-1/3}$ |

**8.** A car is negotiating a curved road of radius $R$. The road is banked at an angle $\theta$. The coefficient of friction between the tyre of the car and the road is $\mu_s$. The maximum safe velocity on this road is:

1. $\sqrt{\mathrm{gR}\left(\dfrac{\mu_s + \tan\theta}{1 - \mu_s \tan\theta}\right)}$
2. $\sqrt{\dfrac{\mathrm{g}}{\mathrm{R}}\left(\dfrac{\mu_s + \tan\theta}{1 - \mu_s \tan\theta}\right)}$
3. $\sqrt{\dfrac{\mathrm{g}}{\mathrm{R}^2}\left(\dfrac{\mu_s + \tan\theta}{1 - \mu_s \tan\theta}\right)}$
4. $\sqrt{\mathrm{gR}^2\left(\dfrac{\mu_s + \tan\theta}{1 - \mu_s \tan\theta}\right)}$

**9.** If an unpolarised light is incident on a plane surface of refractive index $\sqrt{3}$ at Brewster's angle, then the angle of refraction is:
1. $0^\circ$
2. $30^\circ$
3. $60^\circ$
4. $90^\circ$

**10.** The capacitors are initially uncharged. The three points $A, B, C$ are maintained at potentials $V_A = 4$ V, $V_B = 1$ V and $V_C = 1$ V. The potential at $X$, $V_X =$




1. 2 V
2. 1.5 V
3. 3 V
4. 0.5 V

**11.** In a sample of hydrogen atoms, one atom goes through a transition $n = 3 \rightarrow$ ground state with emitted wavelength $\lambda_1$. Another atom goes through a transition $n = 2 \rightarrow$ ground state with emitted wavelength $\lambda_2$. The ratio of $\dfrac{\lambda_1}{\lambda_2} =$

| | | | |
|---|---|---|---|
| 1. | $\dfrac{6}{5}$ | 2. | $\dfrac{5}{6}$ |
| 3. | $\dfrac{27}{32}$ | 4. | $\dfrac{32}{27}$ |

**12.** According to the law of equipartition of energy, the number of vibrational modes of a polyatomic gas of constant $\gamma = \dfrac{C_\mathrm{p}}{C_\mathrm{v}}$ is (where $C_p$ and $C_v$ are the specific heat capacities of the gas at constant pressure and constant volume, respectively):

| | | | |
|---|---|---|---|
| 1. | $\dfrac{4+3\gamma}{\gamma-1}$ | 2. | $\dfrac{3+4\gamma}{\gamma-1}$ |
| 3. | $\dfrac{4-3\gamma}{\gamma-1}$ | 4. | $\dfrac{3-4\gamma}{\gamma-1}$ |

**13.** The product of the angular momentum and the kinetic energy of an electron in the $n^{\text{th}}$ Bohr orbit in a hydrogen atom is proportional to:

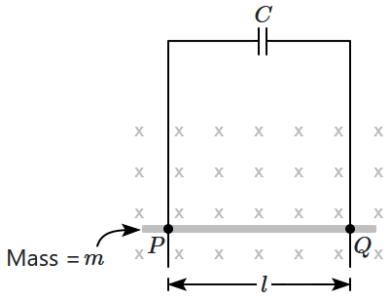
1. $n$
2. $n^2$
3. $\frac{1}{n}$
4. $\frac{1}{n^3}$

**14.** Given below are two statements:

| | |
|---|---|
| **Assertion (A):** | The isothermal curves intersect each other at a certain point. |
| **Reason (R):** | The isothermal changes, take place rapidly, so the isothermal curves have very little slope. |

| | |
|---|---|
| 1. | Both **(A)** and **(R)** are True and **(R)** is the correct explanation of **(A)**. |
| 2. | Both **(A)** and **(R)** are True but **(R)** is not the correct explanation of **(A)**. |
| 3. | **(A)** is True but **(R)** is False. |
| 4. | Both **(A)** and **(R)** are False. |

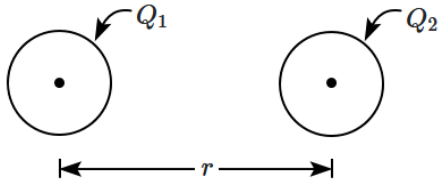
**15.** In the system shown in the figure, the horizontal rod falls vertically down under its own weight while retaining electrical contact with parallel rails. There is no resistance in the circuit, and there is a uniform horizontal magnetic field into the plane. The acceleration of the rod $PQ$, as it falls down is '$a$'.




Then:

| | |
|---|---|
| 1. | $a = g$ |
| 2. | $a > g$ |
| 3. | $a < g$ |
| 4. | $a$ is initially less than $g$, but later it is greater than $g$. |

**16.** Two uniformly charged spheres of radii $R$, carrying charges $Q_1$ and $Q_2$ are placed with their centres a distance $r$, apart. The force between the spheres is: $(r \gg R)$




| | | | |
|---|---|---|---|
| 1. | $k\frac{Q_1Q_2}{r^2}$ | 2. | $k\frac{Q_1Q_2}{(r^2-R^2)}$ |
| 3. | $k\frac{Q_1Q_2}{r^2+R^2}$ | 4. | $k\frac{Q_1Q_2}{(r+R)^2}$ |

**17.** A bullet of mass $m$ hits a stationary block of mass $M$ elastically. The transfer of energy is the maximum, when:

1. $M = m$
2. $M = 2m$
3. $M \ll m$
4. $M \gg m$

**18.** The current in an inductor of self-inductance 4 H changes from 4 A to 2 A in 1 s. The emf induced in the coil is:

1. $-2$ V
2. 2 V
3. $-4$ V
4. 8 V

**19.** A simple pendulum is vibrating in an evacuated chamber. It will oscillate with:

| | | | |
|---|---|---|---|
| 1. | constant amplitude | 2. | decreasing amplitude |
| 3. | increasing amplitude | 4. | none of these |

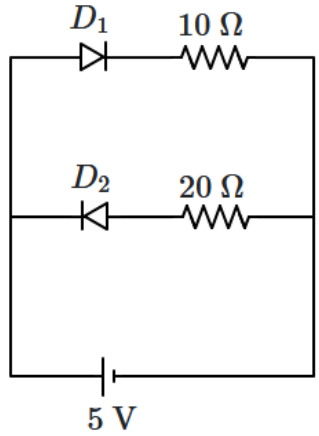
**20.** The two lowest notes on the piano are $A_0$ (27.5 Hz) and $A\#_0$ (29.1 Hz). If you play the notes simultaneously, the resulting sound seems to turn off and on and off and on. How much time exists between the successive "on" s?

1. 0.6 s
2. 1.6 s
3. 28.3 s
4. 56.6 s

**21.** The potential energy of a particle moving along the $x$-direction varies as $V = \dfrac{Ax^2}{\sqrt{x}+B}$. The dimensions of $\dfrac{A^2}{B}$ are:

1. $[M^{3/2}L^{1/2}T^{-3}]$
2. $[M^{1/2}LT^{-3}]$
3. $[M^{2}L^{1/2}T^{-4}]$
4. $[ML^{2}T^{-4}]$

**22.** Two ideal diodes are connected to a battery as shown in the circuit. The current supplied by the battery is:




| | | | |
|---|---|---|---|
| 1. | 0.75 A | 2. | zero |
| 3. | 0.25 A | 4. | 0.5 A |

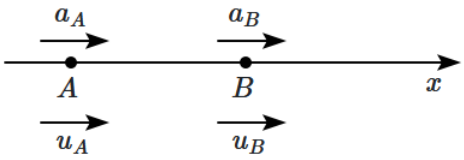
**23.** Two semi-circular current-carrying wires are placed in the same plane so that they share a common centre. The magnetic field due to any one of them at the common centre has the magnitude, $B_O$. When one of them is tilted so that it is in a perpendicular plane, with the same centre, the magnetic field at the common centre is $B$. Then,

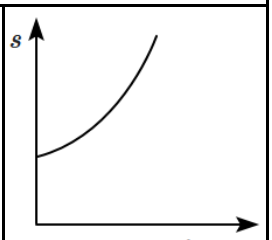
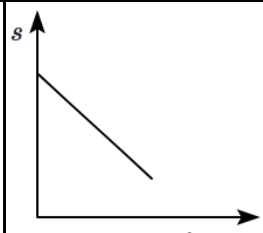
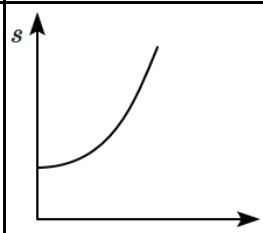
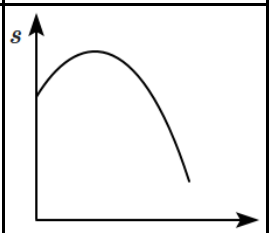
1. $B = 2B_O$
2. $B = \dfrac{B_O}{2}$
3. $B = \sqrt{2}B_O$
4. $B = \dfrac{B_O}{\sqrt{2}}$

**24.** If two particles of masses 2 kg and 3 kg are placed at the two ends of a 1 m (light) rod, then the center-of-mass will be:

| | |
|---|---|
| 1. | 40 cm from the 2 kg particle |
| 2. | 60 cm from the 3 kg particle |
| 3. | 60 cm from the 2 kg particle |
| 4. | 20 cm from the 3 kg particle |

**25.** Two particles, $A$ & $B$, move along the $x$-axis (as shown in the figure) with their initial velocities $u_A, u_B$ and their accelerations $a_A, a_B$ (constant accelerations). Their relative separation $s$ is measured from $A$ towards $B$, with the initial condition as depicted in the figure. Match the conditions mentioned in **column I** with the corresponding correct graph of $s$, in **column II**.

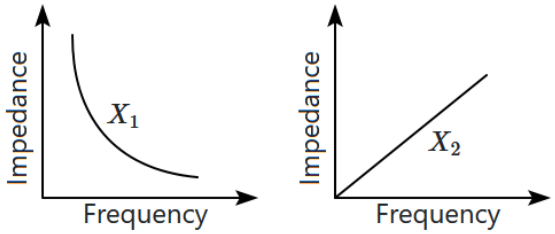



| Column I | | Column II | |
|---|---|---|---|
| (A) | $a_A = a_B \neq 0$ | (I) |  |
| (B) | $a_A > a_B, u_A < u_B$ | (II) |  |
| (C) | $a_A < a_B, u_A = u_B$ | (III) |  |
| (D) | $a_A < a_B, u_A < u_B$ | (IV) |  |



| | | | |
|---|---|---|---|
| 1. | A-II, B-I, C-IV, D-III | 2. | A-III, B-IV, C-II, D-I |
| 3. | A-II, B-IV, C-III, D-I | 4. | A-III, B-I, C-II, D-IV |

**26.** The graph (a) and (b) gives the dependence of two reactive impedances $X_1$ and $X_2$ on the frequency of AC voltage applied across them. We can say that:




| | |
|---|---|
| 1. | $X_1$ is an inductor, $X_2$ is a capacitor |
| 2. | $X_1$ is a resistor, $X_2$ is a capacitor |
| 3. | $X_1$ is a capacitor, $X_2$ is an inductor |
| 4. | $X_1$ is a capacitor, $X_2$ is a resistor |

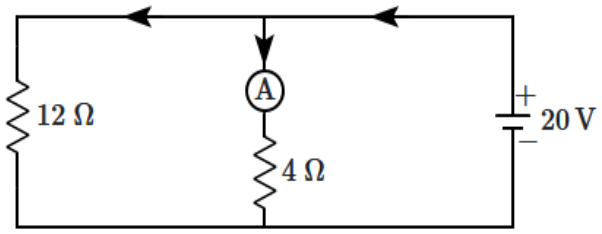
**27.** The mass numbers of two nuclei, A and B, are 27 and 64, respectively. The ratio of their radii is:

1. 3 : 4
2. 5 : 8
3. 2 : 1
4. 1 : 2

**28.** Two light waves having the same wavelength $\lambda$ in vacuum are in phase initially. Then the first wave travels a path of length $L_1$ through a medium of refractive index $n_1$ while the second wave travels a path of length $L_2$ through a medium of refractive index $n_2$. The two waves are then combined to observe interference. The phase difference between the two waves, now, is:

1. $\frac{2\pi}{\lambda}(n_2L_1 - n_1L_2)$
2. $\frac{2\pi}{\lambda}\left(\frac{L_1}{n_1} - \frac{L_2}{n_2}\right)$
3. $\frac{2\pi}{\lambda}(n_1L_1 - n_2L_2)$
4. $\frac{2\pi}{\lambda}\left(\frac{L_2}{n_1} - \frac{L_1}{n_2}\right)$

**29.** In the following figure, the reading of the ammeter A is:
(assume the internal resistance of the battery is zero)

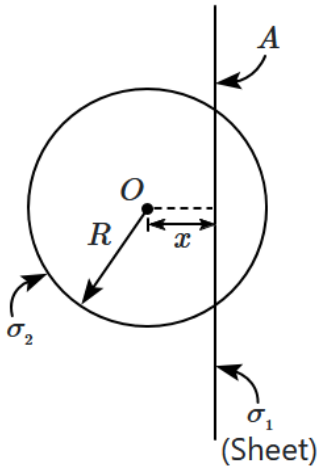



| | |
|---|---|
| 1. | $\frac{20}{3}$ A |
| 2. | $\frac{20}{12}$ A |
| 3. | $\frac{20}{4}$ A |
| 4. | $\left(\frac{20}{3}+\frac{20}{12}\right)$ A |

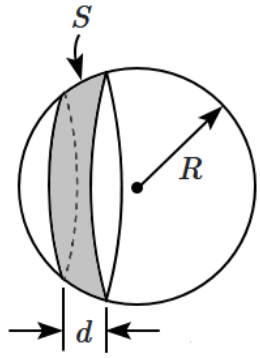
**30.** The time period of an earth satellite in circular orbit is independent of:

| | | | |
|---|---|---|---|
| 1. | the mass of the satellite | 2. | radius of the orbit |
| 3. | none of them | 4. | both of them |

**31.** An infinite plane charged sheet $A$ (uniform charge density-$\sigma_1$) lies at distance $x$ from the centre $(O)$ of a spherical surface of radius $R$. The surface is also uniformly charged with a charge density-$\sigma_2 (x < R)$.




The surface area $(S)$ of a sphere of radius $R$, intercepted between two parallel planes separated by a distance $d$, is given by, $S = (2\pi R)d$




The net flux of the electric field of the plane sheet $(\sigma_1)$, through the surface of the sphere, has the magnitude:

| | | | |
|---|---|---|---|
| 1. | zero | 2. | $\frac{\sigma_1 4\pi R^2}{\varepsilon_0}$ |
| 3. | $\frac{\sigma_1 \pi R^2}{\varepsilon_0}$ | 4. | $\frac{\sigma_1 \pi (R^2 - x^2)}{\varepsilon_0}$ |

**32.** Given below are two statements:

| | |
|---|---|
| **Assertion (A):** | The ratio $\frac{\vec{a} \times \vec{b}}{\vec{a} \cdot \vec{b}} = \tan\theta$, where $\theta$ is the angle between the vectors $\vec{a}, \vec{b}$. |
| **Reason (R):** | The $\vec{a} \times \vec{b}$ has the magnitude: $ab\ \sin\theta$, and $\vec{a}.\vec{b}$ has the magnitude: $ab\ \cos\theta$, where $\theta$ is the angle between the vectors $\vec{a}, \vec{b}$. |

| | |
|---|---|
| 1. | Both **(A)** and **(R)** are True and **(R)** is the correct explanation of **(A)**. |
| 2. | Both **(A)** and **(R)** are True but **(R)** is not the correct explanation of **(A)**. |
| 3. | **(A)** is True but **(R)** is False. |
| 4. | **(A)** is False but **(R)** is True. |

**33.** The following are four different relations about displacement, velocity, and acceleration for the motion of a particle in general.

| | |
|---|---|
| **(a)** | $v_{avg} = \frac{1}{2}[v(t_1) + v(t_2)]$ |
| **(b)** | $v_{avg} = \frac{r(t_2) - r(t_1)}{t_2 - t_1}$ |
| **(c)** | $r = \frac{1}{2}[v(t_2) - v(t_1)](t_2 - t_1)$ |
| **(d)** | $a_{avg} = \frac{v(t_2) - v(t_1)}{t_2 - t_1}$ |

Choose the incorrect option from the given ones:
1. **(a)** and **(d)** only
2. **(a)** and **(c)** only
3. **(b)** and **(c)** only
4. **(a)** and **(b)** only

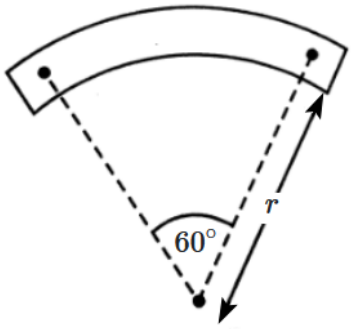
**34.** Which of the following particles, is unstable?
1. Proton
2. Neutron
3. Electron
4. Antineutrino

**35.** Two SHMs are given by: $x_1 = A\sin\omega t$ and $x_2 = B\cos\omega t$; where $A, B$ are constants and $\omega$ is the angular frequency. These are added: $x = x_1 + x_2$
The resulting vibration will:

| | |
|---|---|
| 1. | not be SHM |
| 2. | be SHM of frequency greater than $\omega$ |
| 3. | be SHM of frequency $\omega$ and amplitude $(A + B)$ |
| 4. | be SHM of frequency $\omega$, and amplitude $\sqrt{A^2 + B^2}$ |

**36.** The stopping potential for electrons emitted from a photosensitive surface illuminated with light of wavelength 491 nm is 0.710 V. When the wavelength of the incident light changes, the stopping potential increases to 1.43 V. The new wavelength is approximately:
1. 329 nm
2. 309 nm
3. 382 nm
4. 400 nm

**37.** A bar magnet of length $l$ and magnetic dipole moment $M$ is bent in the form of an arc as shown in the figure. The new magnetic dipole moment will be:

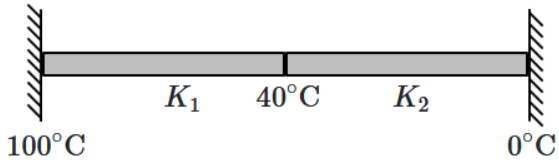



| | | | |
|---|---|---|---|
| 1. | $\frac{3M}{\pi}$ | 2. | $\frac{2M}{l\pi}$ |
| 3. | $\frac{M}{2}$ | 4. | $M$ |

**38.** If a convex lens and a concave lens, both having the same magnitude of power, are placed back-to-back close to each other – the resulting combination will:

| | |
|---|---|
| 1. | behave as a converging lens, if the convex lens faces incident light |
| 2. | behave as a diverging lens, if the convex lens faces incident light |
| 3. | not converge or diverge parallel beams |
| 4. | shift the direction of incident beam |

**39.** Two rods of identical dimensions are joined end-to-end, and the ends of the composite rod are kept at $0^\circ$C and $100^\circ$C (as shown in the diagram). The temperature of the joint is found to be $40^\circ$C. Assuming no loss of heat through the sides of the rods, the ratio of the conductivities of the rods $\frac{K_1}{K_2}$ is:




| | | | |
|---|---|---|---|
| 1. | $\frac{3}{2}$ | 2. | $\frac{2}{3}$ |
| 3. | $\frac{1}{1}$ | 4. | $\frac{\sqrt{3}}{\sqrt{2}}$ |

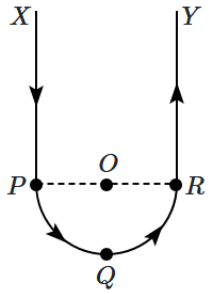
**40.** A bird is flying straight down toward the surface of the water. To a fish located directly below the bird inside the water, the bird will:

| | |
|---|---|
| **(A)** | Appear farther away than it actually is. |
| **(B)** | Appear closer than it actually is. |
| **(C)** | Appear to move faster than its actual speed. |
| **(D)** | Appear to move slower than its actual speed. |

Choose the correct option from the given ones:

| | |
|---|---|
| 1. | **(A)** and **(C)** only |
| 2. | **(A)** and **(B)** only |
| 3. | **(B)** and **(D)** only |
| 4. | **(B), (C)** and **(D)** only |

**41.** A current-carrying wire is bent into the planar form shown in the figure: two very long straight parallel sections $XP$ & $YR$ joined to a semi-circular section $PQR$. Let the magnetic field at $O$ due to the straight sections be $B_0$ and that due to the semi-circular section be $B_1$.




The ratio $B_1/B_0$ equals:

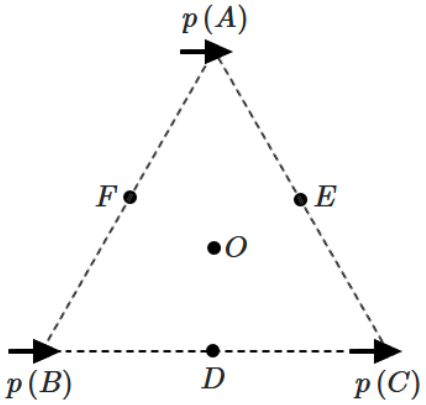
1. $\frac{2}{\pi}$
2. $\frac{\pi}{2}$
3. $\frac{1}{\pi}$
4. $\pi$

**42.** Given below are two statements:

| | |
|---|---|
| **Assertion (A):** | A small drop of mercury is spherical but bigger drops are oval in shape. |
| **Reason (R):** | Surface tension of liquid decreases with increase in temperature. |

| | |
|---|---|
| 1. | Both **(A)** and **(R)** are True and **(R)** is the correct explanation of **(A)**. |
| 2. | Both **(A)** and **(R)** are True but **(R)** is not the correct explanation of **(A)**. |
| 3. | **(A)** is True but **(R)** is False. |
| 4. | **(A)** is False but **(R)** is True. |

**43.** Three identical dipoles of dipole moment $p$ (each) are placed at the three corners of an equilateral triangle $ABC$, of side $a$. The dipoles are parallel to the side ; $BC$.




The potential at the mid-point $(D)$ of side $BC$ is: $\left(k=\frac{1}{4\pi\varepsilon_0}\right)$

| | | | |
|---|---|---|---|
| 1. | zero | 2. | $3\sqrt{3}\frac{kp}{a^2}$ |
| 3. | $\frac{4}{3}\frac{kp}{a^2}$ | 4. | $\left(4+\frac{2}{\sqrt{3}}\right)\frac{kp}{a^2}$ |

**44.** The instantaneous values of alternating current and voltages in a circuit are given as,

$i=\frac{1}{\sqrt{2}}\sin(100\pi t)$ Ampere

$e=\frac{1}{\sqrt{2}}\sin(100\pi t+\pi/3)$ Volt

What is the average power consumed by the circuit in watts?

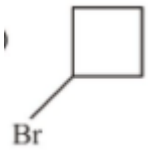
| | | | |
|---|---|---|---|
| 1. | $\frac{\sqrt{3}}{4}$ | 2. | $\frac{1}{2}$ |
| 3. | $\frac{1}{8}$ | 4. | $\frac{1}{4}$ |

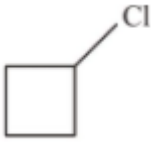
**45.** For a transparent medium relative permeability and permittivity, $\mu_r$ and $\varepsilon_r$ are 1.0 and 1.44 respectively. The velocity of light in this medium would be:

| | | | |
|---|---|---|---|
| 1. | $2.5\times10^8$ m/s | 2. | $3\times10^8$ m/s |
| 3. | $2.08\times10^8$ m/s | 4. | $4.32\times10^8$ m/s |

# Chemistry

**46.** What would be the product formed when 1-bromo-3-chlorocyclobutane reacts with two equivalents of metallic sodium in ether?

1. 


2. 


3. 

4. 

**47.** Which of the following compounds are gem-dihalides?

(a) Ethylidene chloride

(b) Ethylene dichloride

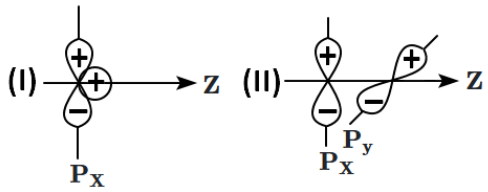
(c) Methylene chloride

(d) Benzyl chloride

Choose the correct option:

| | | | |
|---|---|---|---|
| 1. | (a, b) | 2. | (b, c) |
| 3. | (c, d) | 4. | (a, c) |

**48.** Examine the types of overlaps shown in the following figure and select all the correct statements:




| | |
|---|---|
| **A.** | In figure (I), the net overlap is zero. |
| **B.** | In figure (II), no overlap occurs due to different symmetry. |
| **C.** | In figure (I), the bond formation does not occur. |
| **D.** | In figure (II), bond formation occurs. |

| | | | |
|---|---|---|---|
| 1. | **A** and **B** only | 2. | **A**, **B** and **C** |
| 3. | **B** and **D** only | 4. | **A** and **C** only |

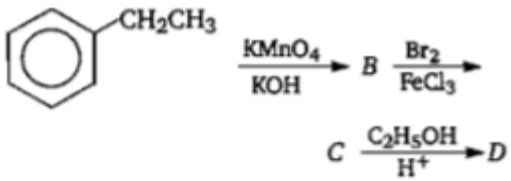
**49.** Arrange the given compounds (A–D) in increasing order based on the rate of HCN addition:
(A) $HCHO$
(B) $CH_3COCH_3$
(C) $PhCOCH_3$
(D) $PhCOPh$

| | | | |
|---|---|---|---|
| 1. | A < B < C < D | 2. | D < B < C < A |
| 3. | D < C < B < A | 4. | C < D < B < A |

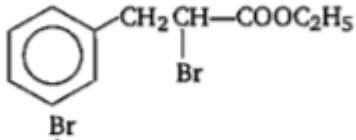
**50.** An element A (at. wt. = 75) and B (at. wt. = 25) combine to form a compound that contains 75% A by weight. The formula of the compound will be:

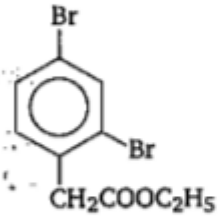
| | | | |
|---|---|---|---|
| 1. | $A_2B$ | 2. | $A_3B$ |
| 3. | $AB_3$ | 4. | AB |

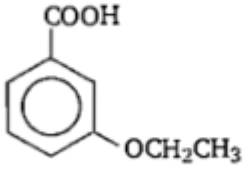
**51.** In a set of reactions, ethyl benzene yielded a product D.

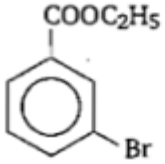



'D' would be

(a) 


(b) 


(c) 


(d) 


**52.** The sum of the coefficients of the reactants in the following reaction is :
$\ldots . CS_2 + \ldots . Cl_2 \rightarrow CCl_4 + \ldots . S_2Cl_2$
1. 5
2. 3
3. 6
4. 4

**53.** If the boiling point of water at 750 mm Hg is 99.63°C, what quantity of sucrose is needed to be dissolved in 500 g of water to achieve a boiling point of 100°C?
(Molal elevation constant for water is 0.52 K kg $mol^{-1}$ )
1. 128.17 g
2. 121.67 g
3. 125.57 g
4. 116.27 g

**54.** Which one of the following is true for any diprotic acid, $H_2X$?
1. $Ka_1 = Ka_2$
2. $Ka_2 > Ka_1$
3. $Ka_1 > Ka_2$
4. $Ka_2 = 1/Ka_1$

**55.** Methyl group attached to a positively charged carbon atom stabilizes the carbocation due to:
1. -I inductive effect
2. Electromeric effect
3. Hyperconjugation
4. Mesomeric effect

**56.** What is the end product in the following sequences of operations?
Acetamide $\xrightarrow{P_2O_5}$ A $\xrightarrow{4H}$ B
1. $CH_3NH_2$
2. $C_2H_5NH_2$
3. $CH_3CN$
4. $CH_3COONH_4$

**57.** Choose the correct statement for the work done in the expansion and heat absorbed or released when 5 liters of an ideal gas at 10 atmospheric pressure isothermally expands into a vacuum until the volume is 15 liters:

| | |
|---|---|
| 1. | Both the heat and work done will be greater than zero. |
| 2. | Heat absorbed will be less than zero and work done will be positive. |
| 3. | Work done will be zero and heat absorbed or evolved will also be zero. |
| 4. | Work done will be greater than zero and heat absorbed will remain zero. |

**58.** Choose the correct statement:

| | |
|---|---|
| 1. | Both diamond and graphite are used as dry lubricants. |
| 2. | Diamond and graphite have a two-dimensional network. |
| 3. | Diamond is covalent and graphite is ionic. |
| 4. | Diamond is $sp^3$ hybridised and graphite is $sp^2$ hybridized. |

**59.** Arrange the reactivity of the given compounds in decreasing order for addition followed by elimination reaction:
(i) p-Cl$-C_6H_4-CHO$
(ii) p-Br$-C_6H_4-CHO$
(iii) p-F$-C_6H_4-CHO$
(iv) p-I$-C_6H_4-CHO$
Select the correct answer from the codes given below:
Codes:
(1) (i), (iii), (ii), (iv)
(2) (i), (iii), (iv), (ii)
(3) (iii), (i), (iv), (ii)
(4) (iii), (i), (ii), (iv)

**60.** Match the species in **Column-I** with their corresponding hybridisation in **Column-II**:

| | **Column-I (Species)** | | **Column-II (Hybridisation)** |
|---|---|---|---|
| A. | Boron in $[B(OH)_4]^-$ | i. | $sp^2$ |
| B. | Aluminium in $[Al(H_2O)_6]^{3+}$ | ii. | $sp^3$ |
| C. | Carbon in Buckminsterfullerene | iii. | $sp^3d^2$ |
| D. | Germanium in $[GeCl_6]^{2-}$ | | |

**Codes:**

| | **A** | **B** | **C** | **D** |
|---|---|---|---|---|
| 1. | ii | iii | i | iii |
| 2. | i | i | iii | ii |
| 3. | iii | ii | ii | i |
| 4. | i | iii | ii | iii |

**61.** The pair of elements where the addition of a second electron to each atom is endothermic is:
1. N, Ne
2. Be, F
3. B, C
4. All of the above

**62.** The correct order of the boiling point of the hydrides of 15th group is:
1. $NH_3 > BiH_3 > SbH_3 > AsH_3 > PH_3$
2. $BiH_3 > NH_3 > SbH_3 > AsH_3 > PH_3$
3. $BiH_3 > SbH_3 > NH_3 > AsH_3 > PH_3$
4. $BiH_3 > SbH_3 > AsH_3 > PH_3 > NH_3$

**63.** One molal solution contains 0.5 moles of a solute in:

| | | | |
|---|---|---|---|
| 1. | 1000 g of solvent | 2. | 500 mL of solvent |
| 3. | 500 g of solvent | 4. | 100 mL of solvent |

**64.** Which transition metal has the lowest ionization energy?
1. Titanium (Ti)
2. Scandium (Sc)
3. Vanadium (V)
4. Manganese (Mn)

**65.** Incorrect statements among the following are:

| | |
|---|---|
| **(a)** | Group I radicals are precipitated as chloride |
| **(b)** | Group IV radicals are precipitated as sulphide |
| **(c)** | Group V radicals are precipitated as hydroxide |
| **(d)** | Group III radicals are precipitated as chloride |

1. **(a)**, **(b)** and **(d)**
2. **(c)** and **(d)**
3. **(a)**, **(b)** and **(c)**
4. **(a)**, **(b)**, **(c)** and **(d)**

**66.** Given below are half-cell reactions:
$MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$,
$E^\circ_{Mn^{2+}}/MnO_4^- = -1.510$ V
$\frac{1}{2}O_2 + 2H^+ + 2e^- \rightarrow H_2O$,
$E^\circ_{O_2/H_2O} = +1.223$ V
Will the permanganate ion, $MnO_4^-$ , liberate $O_2$ from water in the presence of an acid?
1. No, because $E^\circ_{cell} = -2.733$ V
2. Yes, because $E^\circ_{cell} = +0.287$ V
3. No, because $E^\circ_{cell} = -0.287$ V
4. Yes, because $E^\circ_{cell} = +2.733$ V

**67.** In a balanced equation $H_2SO_4 + x\,HI \rightarrow H_2S + y\,I_2 + z\,H_2O$, the values of *x*, *y*, *z* are :

| | |
|---|---|
| 1. | $x = 3, y = 5, z = 2$ |
| 2. | $x = 4, y = 8, z = 5$ |
| 3. | $x = 8, y = 4, z = 4$ |
| 4. | $x = 5, y = 3, z = 4$ |

**68.** Which one of the following pairs is correctly matched?
(1) E1cb reaction, Hofmann elimination
(2) Hofmann rule, most substituted alkene
(3) Saytzeff rule, least substituted alkene
(4) E1 reaction, Hofmann elimination

**69.** Identify the option where hydrogen bonding is not primarily responsible for the following phenomena:

| | |
|---|---|
| 1. | Ice floats in water |
| 2. | Higher Lewis basicity of primary amines than tertiary amines in aqueous solutions |
| 3. | Formic acid is more acidic than acetic acid |
| 4. | Dimerization of acetic acid in benzene |

**70.** The element, from the following, that exhibits the highest number of allotropes is:
1. $O$
2. $S$
3. $Se$
4. $Te$

**71.** The following data is for a reaction between reactants A and B:

| Rate mol $L^{-1}s^{-1}$ | [A] | [B] |
|---|---|---|
| $2 \times 10^{-3}$ | 0.1 M | 0.1 M |
| $4 \times 10^{-3}$ | 0.2 M | 0.1 M |
| $1.6 \times 10^{-2}$ | 0.2 M | 0.2 M |

The order of the reaction with respect to A and B, respectively are:
1. 1, 0
2. 0, 1
3. 1, 2
4. 2, 1

**72.** The hybridization of orbitals of N atom in $NO_3^-$, $NO_2^+$, *and* $NH_4^+$ are respectively:
1. $sp$, $sp^2$, $sp^3$
2. $sp^2$, $sp$, $sp^3$
3. $sp$, $sp^3$, $sp^2$
4. $sp^2$, $sp^3$, $sp$

**73.**

| | |
|---|---|
| **Assertion (A):** | Enthalpy and entropy of any elementary substance in the standard states are taken as zero. |
| **Reason (R):** | At absolute zero, particles of the perfectly crystalline substance become completely motionless. |

| | |
|---|---|
| 1. | Both **(A)** and **(R)** are True and **(R)** is the correct explanation of **(A)**. |
| 2. | Both **(A)** and **(R)** are True but **(R)** is not the correct explanation of **(A)**. |
| 3. | **(A)** is True but **(R)** is False. |
| 4. | **(A)** is false and **(R)** is true. |

**74.** The energy of an electron in the first Bohr orbit of H atom is –13.6 eV. The possible energy value (s) of the excited state(s) for electrons in Bohr orbits of hydrogen is (are):
1. –3.4 eV
2. –4.2 eV
3. –6.8 eV
4. +6.8 eV

**75.** Which of the following salts does not hydrolyze in water?
1. $NH_4Cl$
2. KCl
3. $CH_3COONH_4$
4. $CH_3COOK$

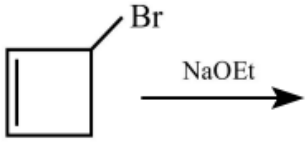
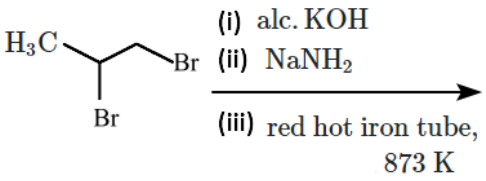
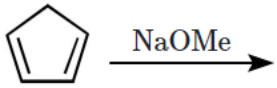
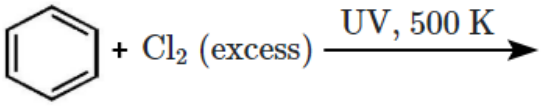
**76.** In acidic medium, $H_2O_2$ changes $Cr_2O_7^{-2}$ to $CrO_5$ which has two (–O – O–) bonds.
The oxidation state of Cr in $CrO_5$ is:
1. +5
2. +3
3. +6
4. -10

**77.** The major product obtained on interaction of phenol with sodium hydroxide and carbon dioxide is:
1. Benzoic acid
2. Salicylaldehyde
3. Salicylic acid
4. Phthalic acid

**78.** Which of the following solutions will cause Mohr's salt to precipitate out as iron (II) hydroxide?

| | | | |
|---|---|---|---|
| 1. | Hydrochloric acid | 2. | Sodium hydroxide |
| 3. | Sulphuric acid | 4. | Potassium nitrate |

**79.** Compounds that yield an aromatic compound as the major product are:

| | |
|---|---|
| a. |   |
| b. |   |
| c. |   |
| d. |   |

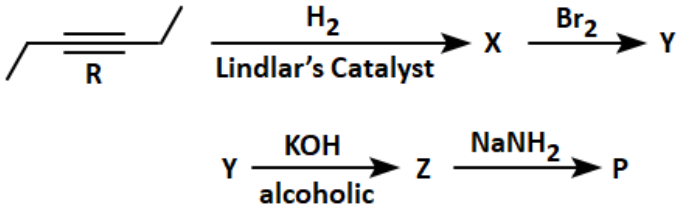
1. a, c
2. b, c
3. b, d
4. None of the above.

**80.** Tetrahedral and diamagnetic compound among the following is:

| | | | |
|---|---|---|---|
| 1. | $[NiCl_4]^{2-}$ | 2. | $[Ni(CN)_4]^{2-}$ |
| 3. | $Ni(CO)_4$ | 4. | $[Ni(H_2O)_6]^{2+}$ |

**81.** Why does a rise in temperature increase the rate of a chemical reaction?
1. An increased number of effective collisions.
2. An increased momentum of colliding molecules.
3 An increase in the activation energy.
4. A decrease in the activation energy.

**82.**




For the reaction sequence given above, R and P are:
1. Geometrical isomers
2. The same compound
3. Positional isomers
4. Non-isomeric different compounds

**83.**
A. Phenol
B. p-Cresol
C. m-Nitrophenol
D. p-Nitrophenol
The correct order of acidic strength of the above compounds is:

| | | | |
|---|---|---|---|
| 1. | D > C > A > B | 2. | B > D > A > C |
| 3. | A > B > D > C | 4. | C > B > A > D |

**84.** Which of the following is an isomer of ethanol?

| | | | |
|---|---|---|---|
| 1. | Methanol | 2. | Diethyl ether |
| 3. | Acetone | 4. | Dimethyl ether |

**85.** Select the correct option based on statements given below:

| | |
|---|---|
| **Assertion (A):** | Vinyl chloride doesn't give a substitution reaction. |
| **Reason (R):** | Carbon chloride bond has double bond character due to resonance. |

| | |
|---|---|
| 1. | Both **(A)** and **(R)** are True and **(R)** is the correct explanation of **(A)**. |
| 2. | Both **(A)** and **(R)** are True but **(R)** is not the correct explanation of **(A)**. |
| 3. | **(A)** is True but **(R)** is False. |
| 4. | Both **(A)** and **(R)** are False. |

**86.** The complex that does not involve inner orbital hybridisation among the following is:
1. $[CoF_6]^{3-}$
2. $[Co(NH_3)_6]^{3+}$
3. $[Fe(CN)_6]^{3-}$
4. $[Cr(NH_3)_6]^{3+}$

**87.** Fat soluble vitamin among the following is:
1. Thiamine
2. Pyridoxine
3. Vitamin C
4. Vitamin A

**88.** Cheilosis occurs due to the deficiency of:

| | | | |
|---|---|---|---|
| 1. | Thiamine | 2. | Nicotinamide |
| 3. | Pyridoxamine | 4. | Riboflavin |

**89.**

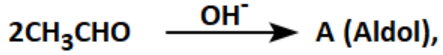
| | |
|---|---|
| **Statement I:** | EMF of a cell is an additive property. |
| **Statement II:** | $\Delta G^\circ$ of a cell is an additive property. |

| | |
|---|---|
| 1. | Both **Statement I** and **Statement II** are False |
| 2. | Both **Statement I** and **Statement II** are True |
| 3. | **Statement I** is True but **Statement II** is False |
| 4. | **Statement I** is False but **Statement II** is True |

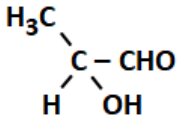
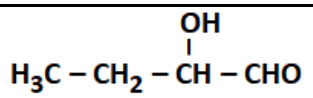
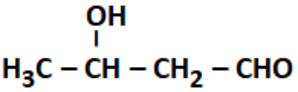
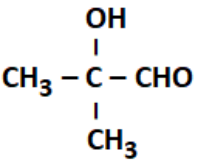
**90.** Case study

Aldol Condensation

When two carbonyl compounds having $\alpha-$hydrogen atoms are condensed in presence of dilute alkali to form a compound that has the properties of alcohol as well as carbonyl compound, the compound is known as ALDOL. Aldol is unstable and on heating, it eliminates one $H_2O$ molecule and is converted into $\alpha,\beta-$ unsaturated aldehyde or ketone




Compound 'A' is:

| | |
|---|---|
| 1. |  |
| 2. |  |
| 3. |  |
| 4. |  |

# Biology

**91.** Occurrence of which of the following is unlikely?

| | |
|---|---|
| 1. | Ciliated epithelium in fallopian tube |
| 2. | Cuboidal brush bordered epithelium in PCT |
| 3. | Columnar brush bordered epithelium in small intestine |
| 4. | Compound epithelium at the diffusion boundaries |

**92.** Which of the following conditions will stimulate parathyroid gland to release parathyroid hormone?

1. Fall in active Vitamin D levels
2. Fall in blood $Ca^{+2}$ levels
3. Fall in bone $Ca^{+2}$ levels
4. Rise in blood $Ca^{+2}$ levels

**93.** Which of the following is the correct sequence of events in a pollen sac?

| | |
|---|---|
| 1. | sporangia → meiosis → two haploid cells → meiosis → two pollen grains per cell |
| 2. | pollen grain → meiosis → two generative cells → two tube cells per pollen grain |
| 3. | two haploid cells → meiosis → generative cell → tube cell-fertilization → pollen grain |
| 4. | microsporocyte → meiosis → microspores → mitosis → two haploid cells per pollen grain |

**94.** The supportive skeletal structures in the human external ears and the nose tip are examples of:

1. Areolar tissue
2. Bone
3. Cartilage
4. Ligament

**95.** How many of the given statements are correct:

| | |
|---|---|
| **I:** | Thyroid hormones play an important role in the regulation of the basal metabolic rate. |
| **II:** | Thyroid hormones are most important factors that affect the process of red blood cell formation. |
| **III:** | Thyroid hormones control the metabolism of carbohydrates but not of proteins and fats. |
| **IV:** | Maintenance of water and electrolyte balance is also influenced by thyroid hormones. |

| | | | |
|---|---|---|---|
| 1. | 1 | 2. | 2 |
| 3. | 3 | 4. | 4 |

**96.** Who, amongst the following, is revered as the father of ecology in India?

1. Gurdev Singh Khush
2. M. S. Swaminathan
3. Ramdeo Misra
4. Salim Ali

**97.** Menstrual bleeding is directly correlated to:

1. low levels of ovarian hormones
2. high levels of ovarian hormones
3. high levels of LH
4. low levels of LH

**98.** Transition state structure of the substrate formed during an enzymatic reaction is:
1. permanent but unstable
2. transient and unstable
3. permanent and stable
4. transient but stable

**99.** The neural system:

| | |
|---|---|
| **I:** | provides a point-to-point rapid coordination among organs. |
| **II:** | is fast but short-lived. |
| **III:** | innervate all cells of the body. |

1. Only **I** and **II** are correct
2. Only **I** and **III** are correct
3. Only **II** and **III** are correct
4. **I**, **II** and **III** are correct

**100.** The process of individuals of the same species that have come into the habitat from elsewhere during the time period under consideration is referred as:
1. Association
2. Emigration
3. Competition
4. Immigration

**101.** During ventricular diastole:

| | |
|---|---|
| **I:** | closure of semilunar valves occurs. |
| **II:** | the tricuspid and bicuspid valves are pushed open. |

1. Only **I** is correct
2. Only **II** is correct
3. Both **I** and **II** are correct
4. Both **I** and **II** are incorrect

**102.** A plasmid has two genes providing resistance to antibiotics A and B respectively. A foreign DNA has been inserted within the gene for resistance to antibiotic A:

| | |
|---|---|
| **I.** | Non-Transformants will not survive in a medium containing antibiotic A and in a medium containing antibiotic B. |
| **II.** | Recombinant transformants will survive in a medium containing antibiotic B but not in a medium containing antibiotic A. |
| **III.** | Non-recombinant transformants will survive in a medium containing antibiotic A and in a medium containing antibiotic B. |

1. Only **I** and **II** are correct
2. Only **I** and **III** are correct
3. Only **II** and **III** are correct
4. **I**, **II** and **III** are correct

**103.** Exhalation of air into the lungs can be brought about by:
**I:** Contraction of diaphragm
**II:** Contraction of internal intercostal muscles
**III:** Contraction of external intercostal muscles
1. Only **I** and **II**
2. Only **II**
3. Only **I** and **III**
4. Only **III**

**104.** Prevention of implantation can be a mechanism of action of all the following methods of contraception except:

| | |
|---|---|
| **I:** | Intra-uterine devices |
| **II:** | Oral contraceptive combination pills |
| **III:** | Barrier contraceptives |

| | | | |
|---|---|---|---|
| 1. | Only **III** | 2. | Only **I** and **II** |
| 3. | Only **I** | 4. | Only **II** |

**105.** All vertebrates are chordates but all chordates are not vertebrates, why?

| | |
|---|---|
| 1. | Notochord is replaced by a vertebral column in the adults of some chordates. |
| 2. | The ventral hollow nerve cord remains throughout life in some chordates. |
| 3. | All chordates possess a vertebral column. |
| 4. | All chordates possess notochords throughout their lives. |

**106.** What is the primary structural precursor to the new cell wall formed during plant cytokinesis?
1. Cell plate
2. Middle lamella
3. Spindle fibres
4. Metaphase plate

**107.** The semi-conservative model of DNA replication, experimentally confirmed by Meselson and Stahl, utilized the incorporation of a heavy isotope of nitrogen (15N) to demonstrate that after one round of replication in 14N medium, DNA molecules consisted of:

| | |
|---|---|
| 1. | One completely 15N strand and one completely 14N strand |
| 2. | Two hybrid strands, each consisting of half 15N and half 14N |
| 3. | One hybrid strand and one 15N strand |
| 4. | One hybrid strand and one completely 14N strand |

**108.** A positive-feedback between which of the two given hormones leads to the rupture of Graafian Follicle?
1. LH, estrogen
2. FSH, estrogen
3. LH, progesterone
4. FSH, progesterone

**109.** How can tissue culture be used to produce virus-free plants from infected plants?

| | |
|---|---|
| 1. | By removing the infected leaves and growing them in sterile conditions. |
| 2. | By isolating and growing the virus-free meristem from infected plants. |
| 3. | By using pesticides in the growth medium to kill the virus. |
| 4. | By exposing the infected plants to ultraviolet light to eliminate the virus. |

**110.** The frog's nervous system is categorised as:

| | |
|---|---|
| 1. | Exclusively autonomic nervous system |
| 2. | Only central nervous system |
| 3. | Central nervous system with paired nerves in peripheral nervous system |
| 4. | Central nervous system with unpaired nerves in peripheral nervous system |

**111.** Centromere is required for
1. transcription
2. crossing over
3. cytoplasmic cleavage
4. movement of chromosomes towards poles

**112.** A unicellular organism shows:

| | |
|---|---|
| **I:** | Eukaryotic cell type |
| **II:** | Absent cell wall |
| **III:** | Capability to act as a heterotroph when deprived of sunlight |

This organism must be classified under:

| | |
|---|---|
| 1. | Kingdom Monera, as a mycoplasma |
| 2. | Kingdom Protista, as a euglenoid |
| 3. | Kingdom Protista, as a dinoflagellate |
| 4. | Kingdom Animalia, as a sponge |

**113.** Which of the following values will not be normal for a healthy person?
1. 10 gms of haemoglobin per 100 ml of blood
2. 5 million RBC per $mm^3$
3. 7000 WBC per $mm^3$
4. 200000 platelets per $mm^3$

**114.** The first clinical gene therapy was given in 1990 to correct:

| | | | |
|---|---|---|---|
| 1. | Sickle cell anaemia | 2. | ADA deficiency |
| 3. | Phenylketonuria | 4. | Burkitt's lymphoma |

**115.** During muscular contraction, which of the following events occur?

| | |
|---|---|
| **(a)** | 'H' zone disappears |
| **(b)** | 'A' band widens |
| **(c)** | 'I' band reduces in width |
| **(d)** | Myosin hydrolyzes ATP, releasing the ADP and Pi |
| **(e)** | Z-lines attached to actins are pulled inwards |

Choose the correct answer from the options given below:
1. **(b), (c), (d), (e)** only
2. **(b), (d), (e), (a)** only
3. **(a), (c), (d), (e)** only
4. **(a), (b), (c), (d)** only

**116.** In an epigynous flower, the ovary is situated:

| | |
|---|---|
| 1. | below other floral parts |
| 2. | above other floral parts |
| 3. | at the same level as other floral parts |
| 4. | not on the thalamus |

**117.** The residual persistent part which forms the perisperm in the seeds of beet is :
1. Calyx
2. Endosperm
3. Nucellus
4. Integument

**118.** Morgan, in his experiment on fruit flies, found that the genes white and yellow were very tightly linked and showed:

| | | | |
|---|---|---|---|
| 1. | 50 % recombination | 2. | 37.2 % recombination |
| 3. | 12.5 % recombination | 4. | 1.3 % recombination |

**119.** The documented effects of ethylene on plants include all the following, except:

| | |
|---|---|
| 1. | It breaks seed and bud dormancy |
| 2. | It initiates germination in peanut seeds |
| 3. | It does not allow sprouting of potato tubers |
| 4. | It promotes root growth and root hair formation. |

**120.** Which of the following best describes metastasis, a property of cancer cells?

| | |
|---|---|
| 1. | The rapid uncontrolled growth of cells at the original tumor site without spreading to other parts of the body. |
| 2. | The ability of cancer cells to detach from the primary tumor, invade other tissues, and establish secondary tumors in distant organs. |
| 3. | The suppression of tumor growth by immune system cells in the body. |
| 4. | The formation of benign tumors that do not spread beyond their original location. |

**121.** How many of the following common names and biological names are correctly matched?

| | | | |
|---|---|---|---|
| A. | Pila | – | Apple snail |
| B. | Pinctada | – | Pearl oyster |
| C. | Sepia | – | Squid |
| D. | Loligo | – | Cuttlefish |
| E. | Octopus | – | Devil fish |

Options:
1. Two pairs are correctly matched
2. Three pairs are correctly matched
3. Four pairs are correctly matched
4. All five pairs are correctly matched

**122.** What is the primary role of anaerobic sludge digesters in sewage treatment plants?

| | |
|---|---|
| 1. | To aerate the sludge for microbial activity. |
| 2. | To separate suspended solids from effluent. |
| 3. | To sediment bacterial flocs into activated sludge. |
| 4. | To anaerobically digest bacteria and fungi in the sludge and produce biogas. |

**123.** Consider the given two statements:

| | |
|---|---|
| **Assertion (A):** | Before assigning a biological name to a living organism, it is essential to identify the organism correctly. |
| **Reason (R):** | Nomenclature or naming is only possible when the organism is described correctly and we know to what organism the name is attached to. |

| | |
|---|---|
| 1. | Both **(A)** and **(R)** are True but **(R)** does not correctly explain **(A)**. |
| 2. | **(A)** is True but **(R)** is False. |
| 3. | Both **(A)** and **(R)** are True and **(R)** correctly explains **(A)**. |
| 4. | **(A)** is False but **(R)** is True. |

**124.** Doctors use a stethoscope to hear the sounds produced during each cardiac cycle. The second sound is heard when:

| | |
|---|---|
| 1. | AV valves open up |
| 2. | Ventricular walls vibrate due to the gushing of blood from the atria |
| 3. | Semi-lunar valves close down after the blood flows into vessels from the ventricles |
| 4. | AV node receives a signal from SA node |

**125.** Any part of a plant taken out and grown in a test tube under sterile conditions in special nutrient media for generating new plants is called:

| | | | |
|---|---|---|---|
| 1. | Implant | 2. | Explant |
| 3. | Supplant | 4. | Plantlet |

**126.** On a logarithmic scale, the species-area relationship turns out to be a:

| | | | |
|---|---|---|---|
| 1. | Straight line | 2. | Rectangular hyperbola |
| 3. | Bell shaped | 4. | U shaped |

**127.** During translation in living cells, every polypeptide chain formed starts with the amino acid:

| | | | |
|---|---|---|---|
| 1. | lysine | 2. | serine |
| 3. | methionine | 4. | alanine |

**128.** What is brood parasitism?

| | |
|---|---|
| 1. | A parasite feeds on the blood of its host for survival. |
| 2. | A bird lays its eggs in the nest of another bird, relying on the host to incubate and raise its young. |
| 3. | A bird removes the host's eggs and replaces them with its own eggs for incubation. |
| 4. | A predator bird steals eggs from the nest of another bird for consumption. |

**129.** What is the key concept behind plant tissue culture?

| | |
|---|---|
| 1. | Growing plants from seeds in a nutrient-rich solution. |
| 2. | Growing whole plants from explants in a sterile nutrient medium. |
| 3. | Reproducing plants by using their fruits and seeds in controlled conditions. |
| 4. | Crossbreeding two different plant species to create hybrids. |

**130.** Consider the given two statements;

| | |
|---|---|
| **Statement I:** | The action spectrum of photosynthesis overlaps completely with the absorption spectrum of chlorophyll a. |
| **Statement II:** | Accessory pigments like chlorophyll b, xanthophylls, and carotenoids widen the range of light wavelengths that can be utilized for photosynthesis. |

| | |
|---|---|
| 1. | **Statement I** is correct; **Statement II** is correct |
| 2. | **Statement I** is correct; **Statement II** is incorrect |
| 3. | **Statement I** is incorrect; **Statement II** is correct |
| 4. | **Statement I** is incorrect; **Statement II** is incorrect |

**131.** Often described as infoldings of bacterial cell membrane, which of the following structures help in cell wall formation and DNA replication?

1. Inclusion bodies
2. Chromatophores
3. Fimbriae
4. Mesosomes

**132.** Which of the following statements is correct?

| | |
|---|---|
| 1. | The descending limb of loop of Henle is impermeable to water. |
| 2. | The ascending limb of loop of Henle is permeable to water. |
| 3. | The descending limb of loop of Henle is permeable to electrolytes. |
| 4. | The ascending limb of loop of Henle is impermeable to water. |

**133.** Besides starch, pyrenoids in many members of Chlorophyceae, contain:

| | |
|---|---|
| 1. | Double-stranded DNA |
| 2. | A low molecular weight RNA |
| 3. | Protein |
| 4. | Lipids |

**134.** Which PGR, although can be included in the group of both growth promoters and growth inhibitors in plants, is largely an inhibitor of growth activities?
1. Auxins
2. Gibberellins
3. Ethylene
4. Abscisic acid

**135.** Consider the given two statements:

| | |
|---|---|
| **Assertion (A):** | In an ecosystem, producers can only support one level of consumers. |
| **Reason (R):** | The efficiency of energy transfer decreases with each level, with only about 10% of energy passing to the next level. |

| | |
|---|---|
| 1. | Both **(A)** and **(R)** are True and **(R)** explains **(A)**. |
| 2. | Both **(A)** and **(R)** are True but **(R)** does not explain **(A)**. |
| 3. | **(A)** is False but **(R)** is True. |
| 4. | **(A)** is True but **(R)** is False. |

**136.** Arrange in a proper sequence the pathway of sperms from testis to outside in human male reproductive system.
A. Vas deferens
B. Rete testis
C. Seminiferous tubules
D. Vasa efferentia
E. Urethra
F. Epididymis
Choose the correct answer from the options given below:
1. $F \rightarrow A \rightarrow B \rightarrow D \rightarrow E \rightarrow C$
2. $C \rightarrow A \rightarrow B \rightarrow D \rightarrow F \rightarrow E$
3. $B \rightarrow A \rightarrow D \rightarrow C \rightarrow F \rightarrow E$
4. $C \rightarrow B \rightarrow D \rightarrow F \rightarrow A \rightarrow E$

**137.** Which process of the aerobic cellular respiration uses the molecular oxygen directly?
1. Glycolysis
2. Link Reaction
3. Citric acid cycle
4. Electron transport system

**138.** Consider the two statements:

| | |
|---|---|
| **I:** | Most of the developing and underdeveloped world is rich financially, but poor in biodiversity and traditional knowledge. |
| **II:** | Most of the industrialised nations are rich in biodiversity and traditional knowledge related to bio-resources but poor in biotechnology. |

| | |
|---|---|
| 1. | **Statement I** is correct. |
| 2. | **Statement II** is correct. |
| 3. | Both **Statement I** and **Statement II** are correct. |
| 4. | Both **Statement I** and **Statement II** are incorrect. |

**139.** Prosthetic groups are distinguished from other cofactors in that they:
**I:** are organic compounds.
**II:** are tightly bound to the apoenzyme.
1. Only **I** is true
2. Only **II** is correct
3. Both **I** and **II** are correct
4. Both **I** and **II** are incorrect

**140.** The diffusion membrane in the alveoli is composed of:

| | |
|---|---|
| 1. | Thin squamous epithelium, endothelium, and basement membrane |
| 2. | Columnar epithelium and connective tissue |
| 3. | Smooth muscle cells and endothelial cells |
| 4. | Alveolar macrophages and capillary walls |

**141.** Identify the correct statements:

| | |
|---|---|
| **I:** | Macrophages in body and leucocytes in blood exhibit amoeboid movement. |
| **II:** | Passage of ova through the female reproductive tract is facilitated by the ciliary movement. |
| **III:** | Human sperm moves with the help of flagellum |

1. Only **I** and **II**
2. Only **I** and **III**
3. Only **II** and **III**
4. **I**, **II** and **III**

**142.** Match List-I with List-II:

| | **List-I (Biological Name)** | | **List-II (Common name)** |
|---|---|---|---|
| A. | *Asterias* | I. | Sea urchin |
| B. | *Antedon* | II. | Brittle star |
| C. | *Echinus* | III. | Sea lily |
| D. | *Ophiura* | IV. | Star fish |

Choose the correct answer from the options given below:
1. A-III, B-IV, C-II, D-I
2. A-IV, B-III, C-I, D-II
3. A-II, B-III, C-I, D-IV
4. A-I, B-II, C-IV, D-III

**143.** ELISA works on the principle of:

| | |
|---|---|
| 1. | antigen-antibody interaction |
| 2. | radioactive probe tagging |
| 3. | culture of microbe in an artificial medium |
| 4. | histopathology |

**144.** The process by which organisms with different evolutionary history evolve similar phenotypic adaptations in response to a common environmental challenge is called:
1. Convergent evolution
2. Non-random evolution
3. Adaptive radiation
4. Natural selection

**145.** Baculoviruses are used in biocontrol because they:

| | |
|---|---|
| 1. | Enhance plant growth by fixing nitrogen. |
| 2. | Act as a natural pesticide, infecting and killing specific insect pests. |
| 3. | Increase soil fertility by decomposing organic waste. |
| 4. | Produce antibiotics that kill harmful bacteria in the soil. |

**146.** Which of the following joints is not expected to allow any movement?
1. Sutures in the skull
2. Joint between adjacent vertebra
3. Gliding joint
4. Joint between carpal and metacarpal of the thumb

**147.** Consider the given two statements:

| | |
|---|---|
| **Statement I:** | For most animal species, the logistic growth model is considered a more realistic one. |
| **Statement II:** | Animals show a higher diversity than plants. |

1. **Statement I** is correct; **Statement II** is correct
2. **Statement I** is incorrect; **Statement II** is correct
3. **Statement I** is correct; **Statement II** is incorrect
4. **Statement I** is incorrect; **Statement II** is incorrect

**148.** Which part of the human brain plays important roles in the consolidation of information from short-term memory to long-term memory?
1. Amygdala
2. Septum
3. *Hippocampus*
4. Superior colliculi

**149.** Linked genes:

| | |
|---|---|
| **I:** | are located on heterologous chromosomes. |
| **II:** | do not assort independently. |

1. Only **I** is correct
2. Only **II** is correct
3. Both **I** and **II** are correct
4. Both **I** and **II** are incorrect

**150.** Graft rejection by recipient body in transplantation surgery is due to:
1. auto-immune response
2. humoral immune response
3. physiological immune response
4. cell-mediated immune response

**151.** Identify the number of correct statements regarding glycolysis:

| | |
|---|---|
| I: | It occurs in virtually all cells |
| II: | It is also called as HMP pathway |
| III: | It occurs in the cytosol |
| IV: | It is the only process in respiration in anaerobic organisms |

1. 1
2. 2
3. 3
4. 4

**152.** Consider the given two statements:

| | |
|---|---|
| **Statement I:** | *Aedes* mosquito spread diseases like dengue and chikungunya. |
| **Statement II:** | *Gambusia* is used to control mosquito-borne diseases. |

1. Only **Statement I** is correct.
2. Only **Statement II** is correct.
3. Both **Statement I** and **Statement II** are correct.
4. Both **Statement I** and **Statement II** are incorrect.

**153.** A decrease in blood pressure/volume will not cause the release of?

| | | | |
|---|---|---|---|
| 1. | Atrial natriuretic factor | 2. | Aldosterone |
| 3. | ADH | 4. | Renin |

**154.** Restriction enzymes do not act on the DNA of the Host cell in which they are produced because:

| | |
|---|---|
| 1. | Host DNA is packed into chromosomes |
| 2. | Restriction enzymes are ineffective on host DNA |
| 3. | Host DNA does not have the restriction site for the Restriction enzymes |
| 4. | Restriction site of host DNA is methylated |

**155.** The most important measure to check the population explosion in India is:

| | |
|---|---|
| 1. | Enforce one child norm by law with strict penalties for non-compliance |
| 2. | Progressively increasing the statutory marriage age in males to 25 years |
| 3. | Motivate smaller families by using contraceptive methods |
| 4. | Allowing pre-natal sex determination to encourage selective feticide |

**156.** Consider the given two statements:

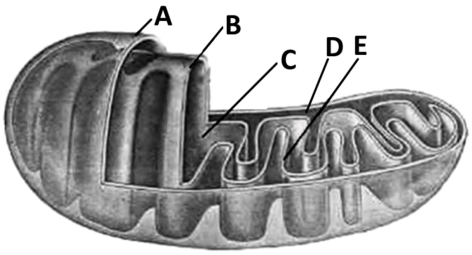
| | |
|---|---|
| **Assertion (A):** | Myelinated neurons transmit nerve impulses faster than unmyelinated neurons. |
| **Reason (R):** | Myelinated neurons form electrical synapse wile unmyelinated neurons form chemical synapse. |

| | |
|---|---|
| 1. | Both **(A)** and **(R)** are True and **(R)** is the correct explanation of **(A)**. |
| 2. | Both **(A)** and **(R)** are True but **(R)** is not the correct explanation of **(A)**. |
| 3. | **(A)** is True but **(R)** is False. |
| 4. | Both **(A)** and **(R)** are False. |

**157.** Which of the following is a characteristic feature of monocot leaves compared to dicot leaves?

| | |
|---|---|
| 1. | Monocot leaves typically exhibit a parallel venation pattern, whereas dicot leaves display a reticulate venation pattern. |
| 2. | Monocot leaves are generally smaller in size and thickness than dicot leaves. |
| 3. | Dicot leaves usually have sheathing leaf bases, unlike monocot leaves. |
| 4. | Monocot leaves possess multiple main veins that originate from the same point at the base. |

**158.** Which of the following statement is correct for the given diagram?




| | |
|---|---|
| 1. | 'C' possesses DNA molecule, RNA molecule and 80 S ribosomes |
| 2. | 'A' and 'B' have their own specific enzymes |
| 3. | 'E' made by inner membrane towards the intermembrane space |
| 4. | 'B' forms the continuous limiting boundary of the organelle |

**159.** When a threatened plant needs urgent measures to save it from extinction, the desirable approach is:

| | | | |
|---|---|---|---|
| 1. | in-situ conservation | 2. | ex-situ conservation |
| 3. | cryopreservation | 4. | biopreservation |

**160.** Apomixis:

| | |
|---|---|
| 1. | is a form of asexual reproduction that mimics sexual reproduction |
| 2. | uniform random fertilization |
| 3. | is production of fruit without fertilisation |
| 4. | a reproductive strategy that involves development of a female (rarely a male) gamete (sex cell) without fertilization |

**161.** Identify the fungal class:

| | |
|---|---|
| **I:** | Commonly known as sac-fungi |
| **II:** | Mycelium is branched and septate |
| **III:** | The asexual spores are conidia produced exogenously |

| | | | |
|---|---|---|---|
| 1. | Phycomycetes | 2. | Ascomycetes |
| 3. | Basidiomycetes | 4. | Deuteromycetes |

**162.** Consider the two statements:

| | |
|---|---|
| **Assertion (A):** | Detritivores play an important role as recyclers in the ecosystem's energy flow and biogeochemical cycles. |
| **Reason (R):** | Detritivores, alongside decomposers, reintroduce vital elements such as carbon, nitrogen, back into the soil, allowing plants to take in these elements and use them for growth. |

| | |
|---|---|
| 1. | Both **(A)** and **(R)** are True and **(R)** correctly explains **(A)**. |
| 2. | Both **(A)** and **(R)** are True but **(R)** does not correctly explain **(A)**. |
| 3. | **(A)** is True but **(R)** is False. |
| 4. | Both **(A)** and **(R)** are False. |

**163.** Photosynthesis is carried out by green plants most effectively in what wavelength range of light?

| | | | |
|---|---|---|---|
| 1. | Green | 2. | Infrared |
| 3. | Blue and red | 4. | Ultraviolet |

**164.** In a continuous culture system:

| | |
|---|---|
| **I:** | the used medium is drained out from one side while fresh medium is added from the other. |
| **II:** | cells are maintained in their physiologically most active log/exponential phase. |

1. Only I is correct
2. Only II is correct
3. Both I and II are correct
4. Both I and II are incorrect

**165.** Intentional or voluntary termination of pregnancy before full term is called:

| | | | |
|---|---|---|---|
| 1. | Contraception | 2. | Spontaneous abortion |
| 3. | Induced abortion | 4. | Feticide |

**166.** Identify the incorrectly matched pair:

| | **PGR** | **Function** |
|---|---|---|
| 1. | Auxin | Inhibition of growth of lateral buds |
| 2. | Gibberellin | Promotion of bolting in plants with rosette habit |
| 3. | Cytokinin | Help overcome apical dominance |
| 4. | ABA | Ripening of fruits |

**167.** Which of the following distinguishes the life cycle of pteridophytes from that of bryophytes?

| | |
|---|---|
| 1. | The main plant body in pteridophytes is haploid, while in bryophytes it is diploid. |
| 2. | In pteridophytes, the gametophyte is independent, while in bryophytes the sporophyte is independent. |
| 3. | Pteridophytes have a dominant sporophyte generation, while bryophytes have a dominant gametophyte generation. |
| 4. | Bryophytes possess well-differentiated vascular tissues, unlike pteridophytes. |

**168.** Which of the following statements is not correct?

| | |
|---|---|
| 1. | Every 100 ml of oxygenated blood can deliver around 5 ml of oxygen to the tissue under normal physiological conditions. |
| 2. | Oxygen gas has most potent effect on the central chemoreceptors and plays most vital role in regulation of respiration |
| 3. | Nearly 70 percent of carbon dioxide is carried as bicarbonate in the blood. |
| 4. | Every 100 ml of deoxygenated blood delivers about 4 ml of carbon dioxide to the alveoli. |

**169.** Consider the following statements:
In a monocot stem-

| | |
|---|---|
| **I:** | Hypodermis is collenchymatous. |
| **II:** | Vascular bundle are collateral and closed. |
| **III:** | Trichomes are usually absent. |

Which of the above statements are true?

| | | | |
|---|---|---|---|
| 1. | **I** and **II** only | 2. | **I** and **III** only |
| 3. | **II** and **III** only | 4. | **I**, **II** and **III** |

**170.** In taxonomy:

| | |
|---|---|
| **I:** | Nomenclature is critical as it allows a particular organism to be known by the same name all over the world. |
| **II:** | Identification is critical as nomenclature or naming is only possible when the organism is described correctly and we know to what organism the name is attached to. |

1. Only **I** is correct
2. Only **II** is correct
3. Both **I** and **II** are correct
4. Both **I** and **II** are incorrect

**171.** The ultimate source of allelic variations in a population is:
1. Recombination
2. Mutation
3. Genetic drift
4. Gene flow

**172.** The human hindbrain comprises three parts, one of which is:

| | | | |
|---|---|---|---|
| 1. | Cerebellum | 2. | Hypothalamus |
| 3. | Spinal | 4. | Corpus callosum |

**173.** Which of the following statements about fatty acids is true?

| | |
|---|---|
| 1. | Saturated fatty acids contain one or more double bonds. |
| 2. | Unsaturated fatty acids lack double bonds. |
| 3. | Fatty acids with a carboxyl group attached to an R group are water-soluble. |
| 4. | Palmitic acid has 16 carbons, including the carboxyl carbon. |

**174.** The average pH of human urine is approximately:
1. 8
2. 7
3. 6
4. 7.5

**175.** Red List contains data or information on?
1. all economically important plants
2. plants whose products are in international trade
3. threatened species
4. marine vertebrates only

**176.** A nucleotide:
**I:** is the monomer of a nucleic acid.
**II:** is a nucleoside monophosphate.
1. Only **I** is correct
2. Only **II** is correct
3. Both **I** and **II** are correct
4. Both **I** and **II** are incorrect

**177.**

| | |
|---|---|
| **Assertion (A):** | Baculovirus are used for control of certain pests in ecologically sensitive areas. |
| **Reason (R):** | Baculoviruses are broad spectrum insecticides. |

| | |
|---|---|
| 1. | Both **(A)** and **(R)** are True and **(R)** correctly explains **(A)** |
| 2. | Both **(A)** and **(R)** are True but **(R)** does not correctly explain **(A)** |
| 3. | **(A)** is True, **(R)** is False |
| 4. | **(A)** is False, **(R)** is False |

**178.** Consider the given two statements:

| | |
|---|---|
| **Assertion (A):** | *Rhizophora*, a mangrove plant, has pneumatophores that emerge above the water level. |
| **Reason (R):** | Pneumatophores help in gaseous exchange and support the plant in anaerobic soil conditions. |

| | |
|---|---|
| 1. | Both **(A)** and **(R)** are True and **(R)** is the correct explanation of **(A)**. |
| 2. | Both **(A)** and **(R)** are True but **(R)** is not the correct explanation of **(A)**. |
| 3. | **(A)** is True but **(R)** is False. |
| 4. | Both **(A)** and **(R)** are False. |

**179.** Consider the given two statements:

| | |
|---|---|
| **Assertion (A):** | Down's syndrome is an example of aneuploidy. |
| **Reason (R):** | The number of chromosomes in a cell in Down's Syndrome is not an exact multiple of 23. |

| | |
|---|---|
| 1. | Both **(A)** and **(R)** are True and **(R)** correctly explains **(A)**. |
| 2. | Both **(A)** and **(R)** are True but **(R)** does not correctly explain **(A)**. |
| 3. | **(A)** is True; **(R)** is False |
| 4. | Both **(A)** and **(R)** are False |

**180.** Analogous structures are results of?

| | | | |
|---|---|---|---|
| 1. | convergent evolution | 2. | shared ancestry |
| 3. | stabilizing selection | 4. | divergent evolution |