# PHYSICS

**1** Identify the function which represents a non-periodic motion?

| | | | |
|---|---|---|---|
| 1. | $e^{-\omega t}$ | 2. | $\sin\omega t$ |
| 3. | $\sin\omega t + \cos\omega t$ | 4. | $\sin(\omega t + \pi/4)$ |

**2** The magnetic field of a plane electromagnetic wave is given by,
$\vec{B} = 3 \times 10^{-8}\cos(1.6 \times 10^{3}x + 48 \times 10^{10}t)\hat{j}$ T.
The associated electric field will be:

| | |
|---|---|
| 1. | $3 \times 10^{-8}\cos\left(1.6 \times 10^{3}x + 48 \times 10^{10}t\right)\hat{i}$ V/m |
| 2. | $3 \times 10^{-8}\sin\left(1.6 \times 10^{3}x + 48 \times 10^{10}t\right)\hat{i}$ V/m |
| 3. | $9\sin\left(1.6 \times 10^{3}x - 48 \times 10^{10}t\right)\hat{k}$ V/m |
| 4. | $9\cos\left(1.6 \times 10^{3}x + 48 \times 10^{10}t\right)\hat{k}$ V/m |

**3** The incorrect statement about the property of a Zener diode is:

| | |
|---|---|
| 1. | Zener voltage remains constant at the breakdown. |
| 2. | It is designed to operate under reverse bias. |
| 3. | The depletion region formed is very wide. |
| 4. | p and n regions of the Zener diode are heavily doped. |

**4** A cell of emf 4 V and internal resistance 0.5 Ω is connected to a 7.5 Ω external resistance. The terminal potential difference of the cell is:

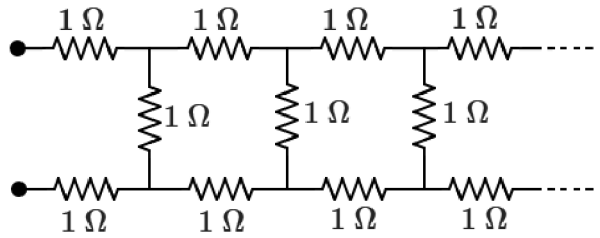
| | | | |
|---|---|---|---|
| 1. | 3.75 V | 2. | 4.25 V |
| 3. | 4 V | 4. | 0.375 V |

**5** Given below are two statements:

| | |
|---|---|
| **Statement I:** | In an AC circuit, the current through a capacitor leads the voltage across it. |
| **Statement II:** | In AC circuits containing pure capacitance only, the phase difference between the current and the voltage is $\pi$. |

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

**6** The equivalent resistance of the infinite network given below is:




1. 2 Ω
2. $(1 + \sqrt{2})$ Ω
3. $(1 + \sqrt{3})$ Ω
4. $(1 + \sqrt{5})$ Ω

**7** A cricket ball is thrown by a player at a speed of 20 m/s in a direction 30° above the horizontal. The maximum height attained by the ball during its motion is: (Take $g = 10$ m/s$^2$)
1. 5 m
2. 10 m
3. 20 m
4. 25 m

**8** A closely packed coil having 1000 turns has an average radius of 62.8 cm. If the current carried by the wire of the coil is 1 A, the value of the magnetic field produced at the centre of the coil will be nearly:
(permeability of free space = $4\pi \times 10^{-7}$ H/m)

| | | | |
|---|---|---|---|
| 1. | $10^{-1}$ T | 2. | $10^{-2}$ T |
| 3. | $10^{2}$ T | 4. | $10^{-3}$ T |

**9** An inductor of inductance 2 mH is connected to a 220 V, 50 Hz ac source. Let the inductive reactance in the circuit is $X_1$. If a 220 V DC source replaces the AC source in the circuit, then the inductive reactance in the circuit is $X_2$. $X_1$ and $X_2$, respectively, are:
1. 6.28 Ω, zero
2. 6.28 Ω, infinity
3. 0.628 Ω, zero
4. 0.628 Ω, infinity

**10** During a cloudy day, a primary and a secondary rainbow may be created. Which of the following statement is correct?

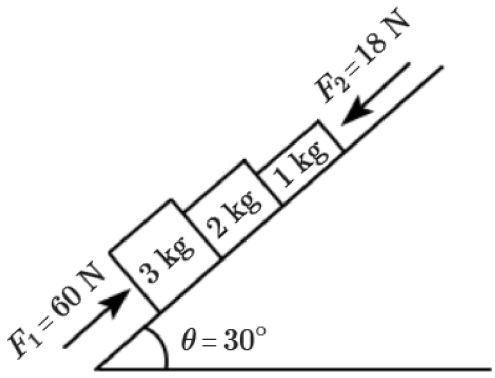
| | |
|---|---|
| 1. | primary rainbow is due to double internal reflection and is formed above the secondary one. |
| 2. | primary rainbow is due to double internal reflection and is formed below the secondary one. |
| 3. | secondary rainbow is due to double internal reflection and is formed above the primary one. |
| 4. | secondary rainbow is due to a single internal reflection and is formed above the primary one. |

**11** The light rays having photons of energy 4.2 eV are falling on a metal surface having a work function of 2.2 eV. The stopping potential of the surface is:

1. 2 eV
2. 2 V
3. 1.1 V
4. 6.4 V

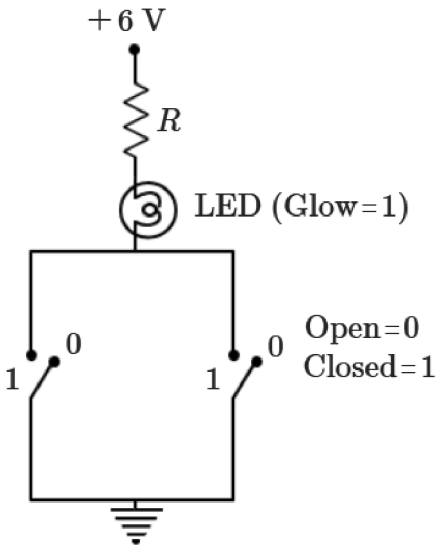
**12** In the diagram shown, the normal reaction force between 2 kg and 1 kg blocks is:

(Consider the surface to be smooth and $g = 10\ \text{ms}^{-2}$ )




1. 25 N
2. 39 N
3. 6 N
4. 10 N

**13** Identify the equivalent logic gate represented by the circuit given below:




1. OR
2. NOR
3. AND
4. NAND

**14** Two copper vessels $A$ and $B$ have the same base area but are of different shapes. $A$ takes twice the volume of water that $B$ requires to fill up to a particular common height. Then the correct statement among the following is:

| | |
|---|---|
| 1. | pressure on the base area of vessels $A$ and $B$ is the same. |
| 2. | pressure on the base area of vessels $A$ and $B$ is not the same. |
| 3. | both vessels $A$ and $B$ weigh the same. |
| 4. | vessel $B$ weighs twice that of $A$. |

**15** The distance between the two plates of a parallel plate capacitor is doubled, and the area of each plate is halved. If $C$ is its initial capacitance, its final capacitance is equal to:

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

**16** The terminal velocity of a copper ball of radius 5 mm falling through a tank of oil at room temperature is 10 cm $s^{-1}$ . If the viscosity of oil at room temperature is 0.9 kg $m^{-1}$ $s^{-1}$, the viscous drag force is:

1. $8.48 \times 10^{-3}$ N
2. $8.48 \times 10^{-5}$ N
3. $4.23 \times 10^{-3}$ N
4. $4.23 \times 10^{-6}$ N

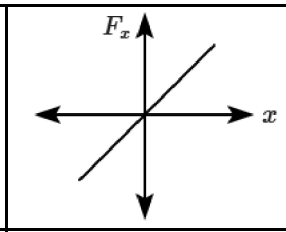
**17** If $\vec{F} = 2\hat{i} + \hat{j} - \hat{k}$ and $\vec{r} = 3\hat{i} + 2\hat{j} - 2\hat{k}$, then the scalar and vector products of $\vec{F}$ and $\vec{r}$ have the magnitudes, respectively, as:

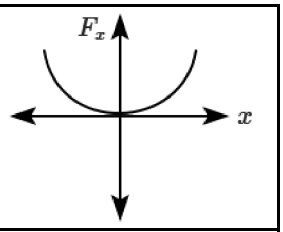
1. $5,\ \sqrt{3}$
2. $4,\ \sqrt{5}$
3. $10,\ \sqrt{2}$
4. $10,\ 2$

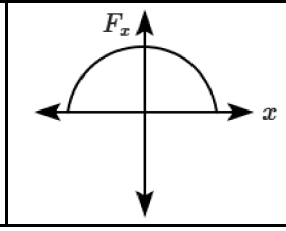
**18** After passing through a polarizer, a linearly polarized light of intensity $I$ is incident on an analyser making an angle of $30^{\circ}$ with the axes of the polariser. The intensity of light emitted from the analyser will be:

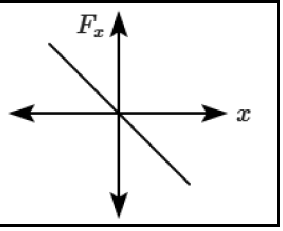
1. $\frac{I}{2}$
2. $\frac{I}{3}$
3. $\frac{3I}{4}$
4. $\frac{2I}{3}$

**19** The restoring force of a spring, with a block attached to the free end of the spring, is represented by:

1. 


2. 


3. 


4. 


**20** If the screen is moved away from the plane of the slits in Young's double slit experiment, then the:

| | |
|---|---|
| 1. | angular separation of the fringes increases. |
| 2. | angular separation of the fringes decreases. |
| 3. | linear separation of the fringes increases. |
| 4. | linear separation of the fringes decreases. |

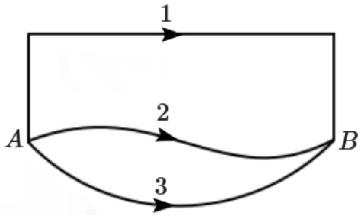
**21** The effective capacitances of two capacitors are 3 $\mu$F and 16 $\mu$F, when they are connected in series and parallel respectively. The capacitance of two capacitors are:

1. 10 $\mu$F, 6 $\mu$F
2. 8 $\mu$F, 8 $\mu$F
3. 12 $\mu$F, 4 $\mu$F
4. 1.2 $\mu$F, 1.8 $\mu$F

**22** The distance covered by a body of mass 5 g having linear momentum 0.3 kg-m/s in 5 s is:

1. 300 m
2. 30 m
3. 3 m
4. 0.3 m

**23** A gravitational field is present in a region, and a mass is shifted from $A$ to $B$ through different paths as shown. If $W_1$, $W_2$ and $W_3$ represent the work done by the gravitational force along their respective paths, then:




| | | | |
|---|---|---|---|
| 1. | $W_1 = W_2 = W_3$ | 2. | $W_1 > W_2 > W_3$ |
| 3. | $W_1 > W_3 > W_2$ | 4. | $W_1 < W_2 < W_3$ |

**24** The reciprocal of resistance is:

| | | | |
|---|---|---|---|
| 1. | reactance | 2. | mobility |
| 3. | conductivity | 4. | conductance |

**25** Given below are two statements:

| | |
|---|---|
| **Assertion (A):** | When a firecracker (rocket) explodes in mid-air, its fragments fly in such a way that they continue moving in the same path, which the firecracker would have followed, had it not exploded. |
| **Reason (R):** | The explosion of cracker (rocket) occurs due to internal forces only and no external force acts for this explosion. |

| | |
|---|---|
| 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. |

**26** The threshold frequency of a photoelectric metal is $\nu_0$. If the light of frequency $4\nu_0$ is incident on this metal, then the maximum kinetic energy of emitted electrons will be:

| | | | |
|---|---|---|---|
| 1. | $h\nu_0$ | 2. | $2h\nu_0$ |
| 3. | $3h\nu_0$ | 4. | $4h\nu_0$ |

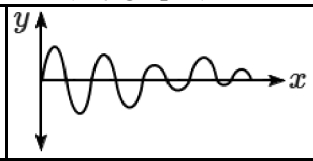
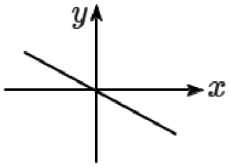
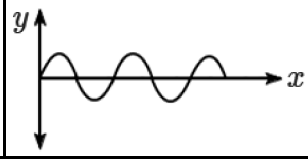
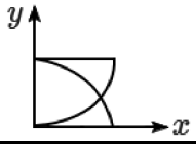
**27** The ratio of the magnitude of the magnetic field and electric field intensity of a plane electromagnetic wave in free space of permeability $\mu_0$ and permittivity $\varepsilon_0$ is: (Given that $c =$ velocity of light in free space)

1. $c$
2. $\dfrac{1}{c}$
3. $\dfrac{c}{\sqrt{\mu_0\varepsilon_0}}$
4. $\dfrac{\sqrt{\mu_0\varepsilon_0}}{c}$

**28** The shape of the magnetic field lines due to an infinite long, straight current carrying conductor is:

| | | | |
|---|---|---|---|
| 1. | a straight line | 2. | circular |
| 3. | elliptical | 4. | a plane |

**29** Match **List-I** with **List-II**.

| | **List-I** ($x$-$y$ graphs) | | **List-II** (Situations) |
|---|---|---|---|
| **(a)** |  | **(i)** | Total mechanical energy is conserved |
| **(b)** |  | **(ii)** | Bob of a pendulum is oscillating under negligible air friction |
| **(c)** |  | **(iii)** | Restoring force of a spring |
| **(d)** |  | **(iv)** | Bob of a pendulum is oscillating along with air friction |

Choose the correct answer from the options given below:

| | **(a)** | **(b)** | **(c)** | **(d)** |
|---|---|---|---|---|
| 1. | **(iv)** | **(ii)** | **(iii)** | **(i)** |
| 2. | **(iv)** | **(iii)** | **(ii)** | **(i)** |
| 3. | **(i)** | **(iv)** | **(iii)** | **(ii)** |
| 4. | **(iii)** | **(ii)** | **(i)** | **(iv)** |

**30** An ideal gas follows a process described by the equation $PV^2 = C$ from the initial $(P_1, V_1, T_1)$ to final $(P_2, V_2, T_2)$ thermodynamics states, where $C$ is a constant. Then:

| | |
|---|---|
| 1. | If $P_1 > P_2$ then $T_1 < T_2$ |
| 2. | If $V_2 > V_1$ then $T_2 > T_1$ |
| 3. | If $V_2 > V_1$ then $T_2 < T_1$ |
| 4. | If $P_1 > P_2$ then $V_1 > V_2$ |

**31** A standard filament lamp consumes 100 W when connected to 200 V AC mains supply. The peak current through the bulb will be:
1. 0.707 A
2. 1 A
3. 1.414 A
4. 2 A

**32** Let $R_1$ be the radius of the second stationary orbit and $R_2$ be the radius of the fourth stationary orbit of an electron in Bohr's model. The ratio of $\frac{R_1}{R_2}$ is:
1. 0.25
2. 0.5
3. 2
4. 4

**33** The physical quantity that has the same dimensional formula as pressure is:
1. Force
2. Momentum
3. Young's modulus of elasticity
4. Coefficient of viscosity

**34** An energy of 484 J is spent in increasing the speed of a flywheel from 60 rpm to 360 rpm. The moment of inertia of the flywheel is:

| | | | |
|---|---|---|---|
| 1. | 0.7 kg-m$^2$ | 2. | 3.22 kg-m$^2$ |
| 3. | 30.8 kg-m$^2$ | 4. | 0.07 kg-m$^2$ |

**35** The magnetic flux linked to a circular coil of radius $R$ is given by:
$\phi = 2t^3 + 4t^2 + 2t + 5$ Wb.
What is the magnitude of the induced EMF in the coil at $t = 5$ s?
1. 108 V
2. 197 V
3. 150 V
4. 192 V

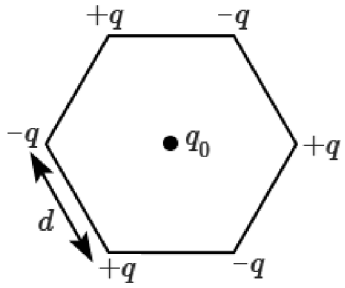
**36** An observer is using an astronomical refracting telescope to observe planets in normal adjustment. The focal lengths of the objective and eyepiece used in the telescope construction are 20 m and 2 cm respectively. Consider the following statements about the telescope:

| | |
|---|---|
| (a) | the distance between the objective and the eyepiece is 20.02 m. |
| (b) | the magnification of the telescope is $-1000$. |
| (c) | the image of the planet is erect and diminished. |
| (d) | the aperture of the eyepiece is smaller than that of the objective. |

The correct statements are:

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

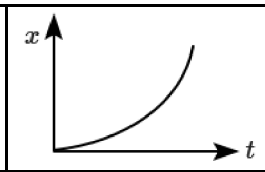
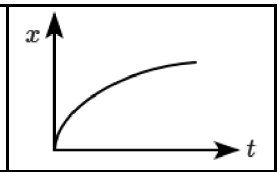
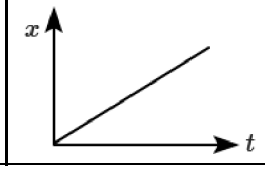
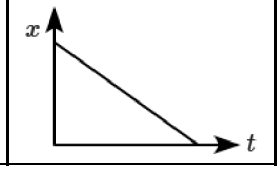
**37** Six charges $+q$, $-q$, $+q$, $-q$, $+q$ and $-q$ are fixed at the corners of a hexagon of side $d$ as shown in the figure. The work done in bringing a charge $q_0$ to the centre of the hexagon from infinity is:
($\varepsilon_0$-permittivity of free space)




| | | | |
|---|---|---|---|
| 1. | zero | 2. | $\frac{-q^2}{4\pi\varepsilon_0 d}$ |
| 3. | $\frac{-q^2}{4\pi\varepsilon_0 d}\left(3 - \frac{1}{\sqrt{2}}\right)$ | 4. | $\frac{-q^2}{4\pi\varepsilon_0 d}\left(6 - \frac{1}{\sqrt{2}}\right)$ |

**38** An organ pipe filled with a gas at 27°C resonates at 400 Hz in its fundamental mode. If it is filled with the same gas at 90°C, the resonance frequency at the same mode will be:
1. 420 Hz
2. 440 Hz
3. 484 Hz
4. 512 Hz

**39** The position-time ($x$-$t$) graph for positive acceleration is:

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

**40** Three vessels of equal capacity have gases at the same temperature and pressure. The first vessel contains helium (monoatomic), the second contains fluorine (diatomic) and the third contains sulfur hexafluoride (polyatomic). The correct statement, among the following, is:

| | |
|---|---|
| 1. | all vessels contain an unequal number of respective molecules. |
| 2. | the root mean square speed of molecules is the same in all three cases. |
| 3. | the root mean square speed of helium is the largest. |
| 4. | the root mean square speed of sulfur hexafluoride is the largest. |

**41** In a gravitational field, the gravitational potential is given by; $V = -\frac{K}{x}$ J/kg. The gravitational field intensity at the point $(2, 0, 3)$ m is:

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

**42** The magnetic field on the axis of a circular loop of radius 100 cm carrying current $I = \sqrt{2}$ A, at a point 1 m away from the centre of the loop is given by:

1. $3.14 \times 10^{-7}$ T
2. $6.28 \times 10^{-7}$ T
3. $3.14 \times 10^{-4}$ T
4. $6.28 \times 10^{-4}$ T

**43** Two rods, one made of copper and the other made of steel, of the same length and same cross-sectional area are joined together. The thermal conductivity of copper and steel are $385\ \text{Js}^{-1}\text{K}^{-1}\text{m}^{-1}$ and $50\ \text{Js}^{-1}\text{K}^{-1}\text{m}^{-1}$ respectively. The free ends of copper and steel are held at 100°C and 0°C respectively. The temperature at the junction is, nearly:

1. 12°C
2. 50°C
3. 73°C
4. 88.5°C

**44** The ratio of Coulomb's electrostatic force to the gravitational force between an electron and a proton separated by some distance is $2.4 \times 10^{39}$. The ratio of the proportionality constant, $k = \frac{1}{4\pi\varepsilon_0}$ to the gravitational constant $G$ is nearly:
(Given that the charge of the proton and electron each $= 1.6 \times 10^{-19}$, the mass of the electron $= 9.11 \times 10^{-31}$ kg, the mass of the proton $= 1.67 \times 10^{-27}$ kg ):

1. $10^{20}$
2. $10^{30}$
3. $10^{40}$
4. 10

**45** The percentage error in the measurement of $g$ is:
(Given, $g = \frac{4\pi^2 L}{T^2}$, $L = (10 \pm 0.1)$ cm, $T = (100 \pm 1)$ s)

1. 2%
2. 5%
3. 3%
4. 7%

# CHEMISTRY

**46** The correct order of bond angles in the following compounds/ species is:

1. $H_2O < NH_3 < NH_4^+ < CO_2$
2. $H_2O < NH_4^+ < NH_3 < CO_2$
3. $H_2O < NH_4^+ = NH_3 < CO_2$
4. $CO_2 < NH_3 < H_2O < NH_4^+$

**47** $K_H$ value for some gases at the same temperature 'T' are given:

| gas | $K_H$/k bar |
|---|---|
| Ar | 40.3 |
| $CO_2$ | 1.67 |
| HCHO | $1.83 \times 10^{-5}$ |
| $CH_4$ | 0.413 |

$K_H$ is Henry's Law constant in water. The order of their solubility in water is :

| | |
|---|---|
| 1. | $Ar < CO_2 < CH_4 < HCHO$ |
| 2. | $Ar < CH_4 < CO_2 < HCHO$ |
| 3. | $HCHO < CO_2 < CH_4 < Ar$ |
| 4. | $HCHO < CH_4 < CO_2 < Ar$ |

**48** The nitrogen oxide(s) that contain(s) N-N bond(s) is(are):

A. $N_2O$
B. $N_2O_3$
C. $N_2O_4$
D. $N_2O_5$

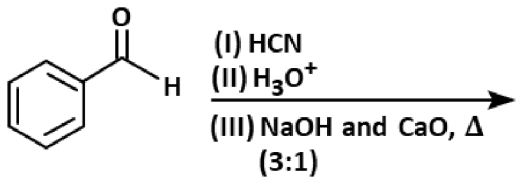
| | | | |
|---|---|---|---|
| 1. | **A**, **B**, and **C** | 2. | **B** and **C** |
| 3. | **D** only | 4. | **A** only |

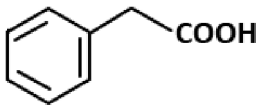
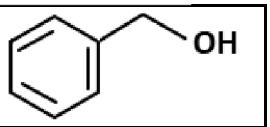
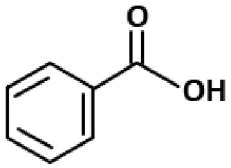
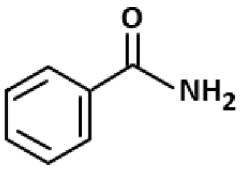
**49** With the electronegativity values provided (H = 2.1, F = 4, Cl = 3.0, Br = 2.8, I = 2.3, N = 3.0), the correct order of decreasing electronegativity difference of the following compounds is:

HF, $NCl_3$, HBr, HI, and HCl

1. $NCl_3 > HF > HCl > HBr > HI$
2. $HF > HCl > HBr > HI > NCl_3$
3. $HI > HBr > HCl > HF > NCl_3$
4. $HF > HCl > NCl_3 > HBr > HI$

**50** The product formed from the following reaction sequence is:




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

**51** Match column I (Reaction) with column II (Product formed) and mark the appropriate choice:

| | **Column - I (Reaction)** | | **Column - II (Product formed)** |
|---|---|---|---|
| **(a)** | Gabriel synthesis | **(i)** | Benzaldehyde |
| **(b)** | Kolbe synthesis | **(ii)** | Ethers |
| **(c)** | Williamson synthesis | **(iii)** | Primary amines |
| **(d)** | Etard reaction | **(iv)** | Salicylic acid |

| | **(a)** | **(b)** | **(c)** | **(d)** |
|---|---|---|---|---|
| 1. | (iii) | (i) | (ii) | (iv) |
| 2. | (ii) | (iii) | (i) | (iv) |
| 3. | (iv) | (iii) | (i) | (ii) |
| 4. | (iii) | (iv) | (ii) | (i) |

**52** The only substance listed below that contains ionic, $\sigma$ and $\pi$ bonds is:

1. $Na_3N$
2. $NO_2$
3. $NaNO_3$
4. $NH_3$

**53** Which of the following reactions is a decomposition redox reaction?

| | |
|---|---|
| 1. | $2Pb(NO_3)_2(s) \rightarrow 2PbO(s) + 4NO_2(g) + O_2(g)$ |
| 2. | $N_2(g) + O_2(g) \rightarrow 2NO(g)$ |
| 3. | $Cl_2(g) + 2OH^-(aq) \rightarrow ClO^-(aq) + Cl^-(aq) + 4H_2O(\ell)$ |
| 4. | $P_4(s) + 3OH^-(aq) + 3H_2O(\ell) \rightarrow PH_3(g) + 3H_2PO_2^-(aq)$ |

**54** The first ionization enthalpies of elements X and Y are 419 kJ $mol^{-1}$ and 590 kJ $mol^{-1}$, respectively and the second ionization enthalpies of X and Y are 3069 kJ $mol^{-1}$ and 1145 kJ $mol^{-1}$, respectively. The correct statement is:

| | |
|---|---|
| 1. | X is an alkali metal and Y is an alkaline earth metal. |
| 2. | X is an alkaline earth metal and Y is an alkali metal. |
| 3. | Both X and Y are alkali metals. |
| 4. | Both X and Y are alkaline earth metals. |

**55** Predict the order of reactivity of the following four isomers towards $S_N2$ reaction.

(I) $CH_3CH_2CH_2CH_2Cl$

(II) $CH_3CH_2CH(Cl)CH_3$

(III) $(CH_3)_2CHCH_2Cl$

(IV) $(CH_3)_3CCl$

| | |
|---|---|
| 1. | (IV) > (III) > (II) > (I) |
| 2. | (I) > (II) > (III) > (IV) |
| 3. | (I) > (III) > (II) > (IV) |
| 4. | (IV) > (II) > (III) > (I) |

**56** Match molecules in List I with the Corresponding shape in List II:

| | **List-I (Molecules)** | | **List-II (Shape)** |
|---|---|---|---|
| (a) | $NH_3$ | (i) | Square pyramidal |
| (b) | $ClF_3$ | (ii) | Trigonal bipyramidal |
| (c) | $PCl_5$ | (iii) | Trigonal pyramidal |
| (d) | $BrF_5$ | (iv) | T-shape |

Choose the correct answer from the options given below:

| | **(a)** | **(b)** | **(c)** | **(d)** |
|---|---|---|---|---|
| 1. | (ii) | (iii) | (iv) | (i) |
| 2. | (iii) | (iv) | (ii) | (i) |
| 3. | (iv) | (iii) | (i) | (ii) |
| 4. | (iii) | (iv) | (i) | (ii) |

**57** Which of the following pairs consists of transition metal ions that are colourless?

| | | | |
|---|---|---|---|
| 1. | $Sc^{3+}, Zn^{2+}$ | 2. | $Ti^{4+}, Cu^{2+}$ |
| 3. | $V^{2+}, Ti^{3+}$ | 4. | $Zn^{2+}, Mn^{2+}$ |

**58** The correct option for the increasing order of 1st ionization enthalpy: $Pb, Sn, Ge, Si$ is:

| | |
|---|---|
| 1. | $Pb < Sn < Ge < Si$ |
| 2. | $Sn < Pb < Si < Ge$ |
| 3. | $Sn < Pb < Ge < Si$ |
| 4. | $Pb < Sn < Si < Ge$ |

**59** Two half cell reactions are given below:

$Co^{3+} + e^- \rightarrow Co^{2+}, E^\circ_{Co^{2+}/Co^{3+}} = -1.81\ V$

$2Al^{3+} + 6e^- \rightarrow 2Al(s), E^\circ_{Al/Al^{3+}} = +1.66\ V$

The standard EMF of a cell with feasible redox reaction will be:

| | | | |
|---|---|---|---|
| 1. | +7.09 V | 2. | +0.15 V |
| 3. | +3.47 V | 4. | –3.47 V |

**60** Match the coordination complexes in **List-I** with their corresponding hybridisation in **List-II** and mark the correct option:

| | **List-I (Coordination complexes)** | | **List-II (Hybridisation of central atoms)** |
|---|---|---|---|
| (A) | $[PtCl_4]^{2-}$ | (I) | $sp^3d$ |
| (B) | $BrF_5$ | (II) | $d^2sp^3$ |
| (C) | $PCl_5$ | (III) | $dsp^2$ |
| (D) | $[Co(NH_3)_6]^{3+}$ | (IV) | $sp^3d^2$ |

Codes:

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

**61** $Na_2B_4O_7 \xrightarrow{heat} X + NaBO_2$

in the above reaction the product "X" is :

| | | | |
|---|---|---|---|
| 1. | $H_3BO_3$ | 2. | $B_2O_3$ |
| 3. | $Na_2B_2O_5$ | 4. | $NaB_3O_5$ |

**62** The correct order of first ionization enthalpy for the given four element is:

| | | | |
|---|---|---|---|
| 1. | C < N < F < O | 2. | C < N < O < F |
| 3. | C < O < N < F | 4. | C < F < N < O |

**63** If 0.01 M acetic acid solution is 1% ionised, then pH of this acetic acid solution is:

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

**64** A compound contains 51.9% carbon, 4.86% hydrogen, and 43.2% bromine by mass. Its empirical formula is:

1. $C_7H_5Br$
2. $C_6H_4Br_3$
3. $C_8H_9Br$
4. $C_{12}H_{22}Br$

**65** The half-life of a first-order reaction is 2000 years. If the concentration after 8000 years is 0.02 M, then the initial concentration was:

1. 0.16 M
2. 0.32 M
3. 0.08 M
4. 0.04 M

**66** One mole of an ideal gas at 300 K is expanded isothermally from 1 L to 10 L volume. $\Delta U$ for this process is:

(Use R = 8.314 J $K^{-1}$ $mol^{-1}$)

| | | | |
|---|---|---|---|
| 1. | 1260 J | 2. | 2520 J |
| 3. | 5040 J | 4. | 0 J |

**67** What is the hybridization shown by $C_1$ and $C_2$ carbons, respectively in the given compound?

$OHC - CH = CH - {}^2CH_2 - {}^1COOCH_3$

| | | | |
|---|---|---|---|
| 1. | $sp^2$ and $sp^3$ | 2. | $sp^2$ and $sp^2$ |
| 3. | $sp^3$ and $sp^2$ | 4. | $sp^3$ and $sp^3$ |

**68** The mass of a 2.5 mL solution (the density of the solution is 2.15 g/mL) in the correct significant figures is:

| | | | |
|---|---|---|---|
| 1. | 5375 × $10^{-3}$ g | 2. | 5.4 g |
| 3. | 5.38 g | 4. | 53.75 g |

**69** Fluorine is a stronger oxidizing agent than chlorine because:

| | |
|---|---|
| (a) | F–F bond has a low enthalpy of dissociation. |
| (b) | Flouride ion ($F^-$) has high hydration enthalpy. |
| (c) | Electron gain enthalpy of fluorine is less negative than chlorine. |
| (d) | Fluorine has a very small size. |

Choose the most appropriate answer from the options given :

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

**70** Match List-I with List-II :

| List-I (Complexes) | | List-II (Type of isomer) | |
|---|---|---|---|
| A. | $[Co(NH_3)_5NO_2]Cl_2$ and $[Co(NH_3)_5ONO]Cl_2$ | I. | Ionisation isomerism |
| B. | $[Cr(NH_3)_6]$ $[Co(CN)_6]$ and $[Cr(CN)_6][Co(NH_3)_6]$ | II. | Coordination isomerism |
| C. | $[Co(NH_3)_5(SO_4)]Br$ and $[Co(NH_3)_5Br]SO_4$ | III. | Linkage isomerism |
| D. | $[Cr(H_2O)_6]Cl_3$ and $[Cr(H_2O)_5Cl]Cl_2.H_2O$ | IV. | Solvate isomerism |

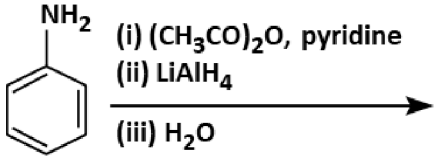
Choose the correct answer from the options given below:

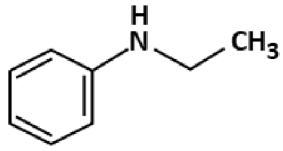
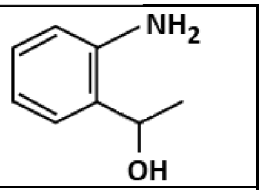
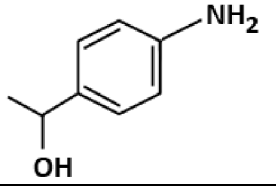
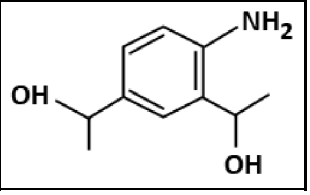
| | (A) | (B) | (C) | (D) |
|---|---|---|---|---|
| 1. | (III) | (I) | (II) | (IV) |
| 2. | (II) | (III) | (IV) | (I) |
| 3. | (III) | (II) | (I) | (IV) |
| 4. | (IV) | (III) | (II) | (I) |

**71** The incorrect statement about the denaturation of proteins is:

| | |
|---|---|
| 1. | It results due to change of temperature and pH. |
| 2. | It results in the loss of biological activity of proteins. |
| 3. | A protein is formed from amino acids linked by peptide bonds. |
| 4. | Uncoiling of the helical structure takes place. |

**72** The product formed from the following reaction sequence is:




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

**73** Select the correct option based on the statements below:

| | |
|---|---|
| **Assertion (A):** | Chlorine is an electron-withdrawing group, yet it exhibits ortho- and para-directing behavior in electrophilic aromatic substitution. |
| **Reason (R):** | Inductive effect of chlorine destabilises the intermediate carbocation formed during the electrophilic substitution, however due to the more pronounced resonance effect, the halogen stabilises the carbocation at ortho and para positions. |

| | |
|---|---|
| 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. |

**74** Which of the following reactions is not an example of nucleophilic addition–elimination reaction?

| | |
|---|---|
| 1. | $CH_3CHO + NaHSO_3 \rightleftharpoons H_3C-\underset{H}{\overset{OH}{\underset{|}{\overset{|}{C}}}}-OSO_2Na$ |
| 2. | $CH_3CHO + NH_2OH \rightleftharpoons CH_3CH = N - OH + H_2O$ |
| 3. | $CH_3CHO + C_6H_5NHNH_2 \rightleftharpoons CH_3CH = N - NHC_6H_5 + H_2O$ |
| 4. | $CH_3CHO + NH_3 \rightleftharpoons CH_3CH = NH + H_2O$ |

**75** The decrease in size from left to right in the actinoid series is greater and more gradual than that in the lanthanoid series due to:

| | |
|---|---|
| 1. | 4f orbitals are penultimate |
| 2. | 4f orbitals have a greater shielding effect |
| 3. | 5f orbitals have a poor shielding effect |
| 4. | 5f orbitals have a greater shielding effect |

**76** What is the correct order of boiling points for the following compounds, arranged from the highest to the lowest?
(a) Heptane
(b) Butane
(c) 2-Methylbutane
(d) 2-Methylpropane
(e) Hexane
Choose the correct option from the following:
1. (a) > (c) > (e) > (d) > (b)
2. (c) > (d) > (a) > (e) > (b)
3. (a) > (e) > (b) > (c) > (d)
4. (a) > (e) > (c) > (b) > (d)

**77** Match the reagents (List-I) with the products (List-II) obtained from phenol:

| | **List-I** | | **List-II** |
|---|---|---|---|
| **(A)** | (i) NaOH<br>(ii) $CO_2$<br>(iii) $H^+$ | **(I)** | Benzoquinone |
| **(B)** | (i) Aqueous NaOH + $CHCl_3$<br>(ii) $H^+$ | **(II)** | Benzene |
| **(C)** | Zn dust, Δ | **(III)** | Salicylaldehyde |
| **(D)** | $Na_2Cr_2O_7$, $H_2SO_4$ | **(IV)** | Salicylic acid |

Choose the correct answer from the options given below:

| | **(A)** | **(B)** | **(C)** | **(D)** |
|---|---|---|---|---|
| 1. | (III) | (IV) | (I) | (II) |
| 2. | (II) | (I) | (IV) | (III) |
| 3. | (IV) | (III) | (II) | (I) |
| 4. | (IV) | (II) | (I) | (III) |

**78** Match List-I with List-II:

| | **List-I (quantum number)** | | **List-II (Orbital)** |
|---|---|---|---|
| (A) | n = 2, $\ell$ = 1 | (I) | 2s |
| (B) | n = 3, $\ell$ = 2 | (II) | 3s |
| (C) | n = 3, $\ell$ = 0 | (III) | 2p |
| (D) | n = 2, $\ell$ = 0 | (IV) | 3d |

Choose the correct answer from the options given below:

| | **(A)** | **(B)** | **(C)** | **(D)** |
|---|---|---|---|---|
| 1. | (III) | (IV) | (I) | (II) |
| 2. | (IV) | (III) | (I) | (II) |
| 3. | (IV) | (III) | (II) | (I) |
| 4. | (III) | (IV) | (II) | (I) |

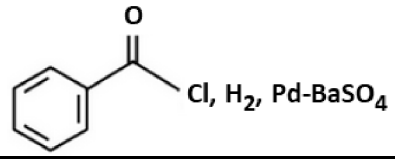
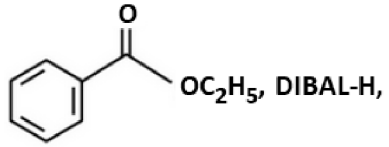
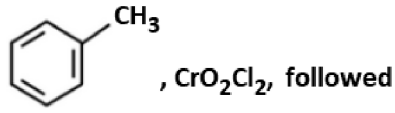
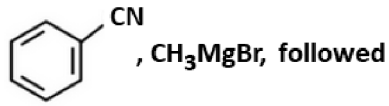
**79** When electromagnetic radiation of wavelength 300 nm falls on the surface of a metal, electrons are emitted with the kinetic energy of $1.68 \times 10^5$ J $mol^{-1}$. The minimum energy needed to remove one mole of electron from the metal is:
($h = 6.626 \times 10^{-34}$ Js, $c = 3 \times 10^8$ $ms^{-1}$, $N_A = 6.022 \times 10^{23}$ $mol^{-1}$)
1. $2.31 \times 10^6$ J $mol^{-1}$
2. $3.84 \times 10^4$ J $mol^{-1}$
3. $3.84 \times 10^{-19}$ J $mol^{-1}$
4. $2.31 \times 10^5$ J $mol^{-1}$

**80** For a chemical reaction, $4A + 3B \rightarrow 6C + 9D$
rate of formation of C is $6 \times 10^{-2}$ mol $L^{-1}$ $s^{-1}$ and rate of disappearance of A is $4 \times 10^{-2}$ mol $L^{-1}$ $s^{-1}$. The rate of reaction and amount of B consumed in interval of 10 seconds, respectively will be:

| | |
|---|---|
| 1. | $1 \times 10^{-2}$ mol $L^{-1}$ $s^{-1}$ and $30 \times 10^{-2}$ mol $L^{-1}$ |
| 2. | $10 \times 10^{-2}$ mol $L^{-1}$ $s^{-1}$ and $10 \times 10^{-2}$ mol $L^{-1}$ |
| 3. | $1 \times 10^{-2}$ mol $L^{-1}$ $s^{-1}$ and $10 \times 10^{-2}$ mol $L^{-1}$ |
| 4. | $10 \times 10^{-2}$ mol $L^{-1}$ $s^{-1}$ and $30 \times 10^{-2}$ mol $L^{-1}$ |

**81** Which of the following methods is incorrect for the synthesis of alkenes?
1. Treatment of alkynes with Na in liquid $NH_3$
2. Heating alkyl halides with alcoholic KOH
3. Treating alkyl halides in aqueous KOH solution
4. Treating vicinal dihalides with Zn metal

**82** The incorrect method to synthesize benzaldehyde is:

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

**83** What fraction of Fe exists as Fe(III) in $Fe_{0.96}O$? (Consider $Fe_{0.96}$ to be made up of Fe(II) and Fe(III) only)

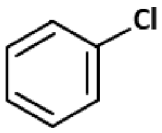
1. $\frac{1}{12}$
2. 0.08
3. $\frac{1}{16}$
4. $\frac{1}{20}$

**84** Select the correct option based on statements below:

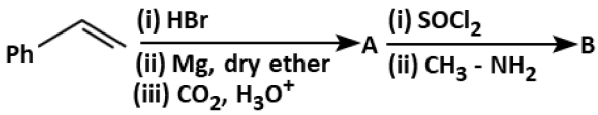
| | |
|---|---|
| **Assertion (A):** | The metal carbon bond in metal carbonyls possesses both $\sigma$ and $\pi$ character. |
| **Reason (R):** | The ligand to metal bond is a $\pi$ bond and metal to ligand bond is a $\sigma$ bond. |

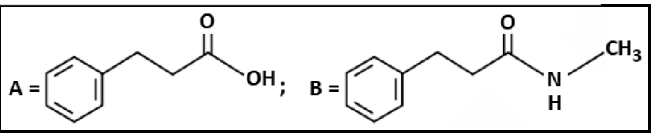
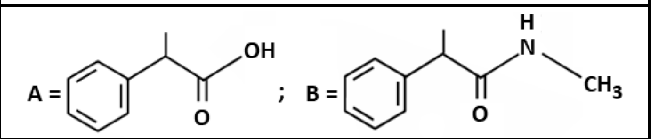
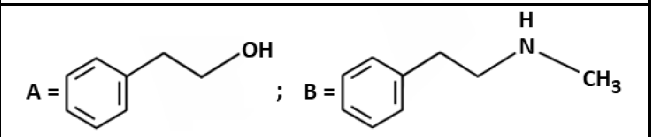
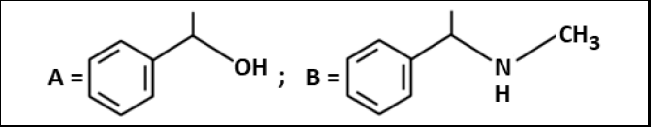
| | |
|---|---|
| 1. | Both **(A)** and **(R)** are True and **(R)** is the correct explanation of **(A)**. |
| 2. | Both **(A)** and **(R)** are True but **(R)** is not the correct explanation of **(A)**. |
| 3. | **(A)** is True but **(R)** is False. |
| 4. | **(A)** is False but **(R)** is True. |

**85** Which one of the following reaction sequences is the incorrect method to prepare phenol?

| | |
|---|---|
| 1. | Aniline, $NaNO_2$ + HCl, $H_2O$, heating |
| 2. | Cumene, $O_2$, $H_3O^+$ |
| 3. |   |
| 4. |   |

**86** The products A and B in the following reaction sequence are :




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

**87** Given below are two statements:

| | |
|---|---|
| **Statement I:** | $Cr^{2+}$ is oxidising agent and $Mn^{3+}$ is a reducing agent in nature. |
| **Statement II:** | $Sc^{3+}$ compounds are repelled by the applied magnetic field. |

In light of the above statements, choose the most appropriate answer from the options given below:

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

**88** $K_p$ for the following reaction is 3.0 at 1000 K.

$CO_2(g) + C(s) \rightarrow 2CO(g)$

The value of $K_c$ for the reaction at the same temperature is:

(Given - R = 0.083 L bar $K^{-1}$ $mol^{-1}$)

| | | | |
|---|---|---|---|
| 1. | 0.36 | 2. | $3.6 \times 10^{-2}$ |
| 3. | $3.6 \times 10^{-3}$ | 4. | 3.6 |

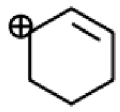
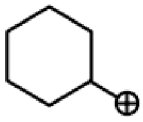
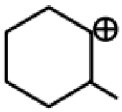
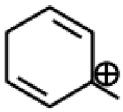
**89** Standard electrode potential for the cell with cell reaction

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

is 1.1 V. Calculate the standard Gibbs energy change for the cell reaction. (Given F = 96487 C $mol^{-1}$)

| | | | |
|---|---|---|---|
| 1. | –200.27 kJ $mol^{-1}$ | 2. | –212.27 kJ $mol^{-1}$ |
| 3. | –212.27 J $mol^{-1}$ | 4. | –200.27 J $mol^{-1}$ |

**90** The most stable carbocation among the following is:

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

# BIOLOGY

**91** Which stage of meiosis can last for months or years in the oocytes of some vertebrates?

1. Leptotene
2. Pachytene
3. Diplotene
4. Diakinesis

**92** When one $CO_2$ molecule is fixed as one molecule of triose phosphate, which of the following photochemically made, high energy chemical intermediates are used in the reduction phase?

1. 1 ATP + 1 NADPH
2. 1 ATP + 2 NADPH
3. 2 ATP + 1 NADPH
4. 2 ATP + 2 NADPH

**93** In lac operon, z gene codes for :

1. $\beta-$galactosidase
2. Permease
3. Repressor
4. Transacetylase

**94** Initiation of lateral roots and vascular cambium during secondary growth takes place in cells of :

| | | | |
|---|---|---|---|
| 1. | Epiblema | 2. | Cortex |
| 3. | Endodermis | 4. | Pericycle |

**95** Match List-I with List-II:

| | **List-I** | | **List-II** |
|---|---|---|---|
| (A) | Adenine | (I) | Pigment |
| (B) | Anthocyanin | (II) | Polysaccharide |
| (C) | Chitin | (III) | Alkaloid |
| (D) | Codeine | (IV) | Purine |

Choose the correct answer from the options given below:

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

**96** Match List-I with List- II

| | **List-I** | | **List-II** |
|---|---|---|---|
| (a) | In lac operon i gene codes for | (i) | transacetylase |
| (b) | In lac operon z gene codes for | (ii) | permease |
| (c) | In lac operon y gene codes for | (iii) | $\beta-$ galactosidase |
| (d) | In lac operon a gene codes for | (iv) | Repressor |

Choose the correct answer from the options given below:

| | (a) | (b) | (c) | (d) |
|---|---|---|---|---|
| 1. | (iii) | (ii) | (i) | (iv) |
| 2. | (iv) | (iii) | (ii) | (i) |
| 3. | (iv) | (i) | (iii) | (ii) |
| 4. | (iii) | (i) | (iv) | (ii) |

**97** Match List-I with List-II:

| | **List-I** | | **List-II** |
|---|---|---|---|
| (a) | *Chlamydomonas* | (i) | Moss |
| (b) | *Cycas* | (ii) | Pteridophyte |
| (c) | *Selaginella* | (iii) | Alga |
| (d) | *Sphagnum* | (iv) | Gymnosperm |

Choose the correct answer from the options given below:

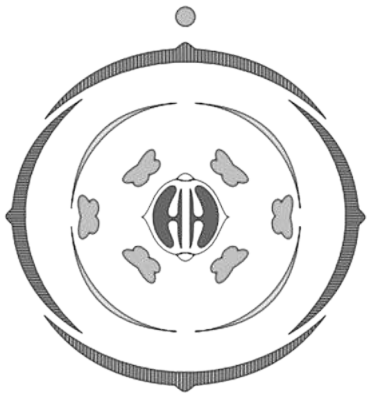
| | (a) | (b) | (c) | (d) |
|---|---|---|---|---|
| 1. | (iii) | (i) | (ii) | (iv) |
| 2. | (iii) | (iv) | (ii) | (i) |
| 3. | (iii) | (ii) | (i) | (iv) |
| 4. | (ii) | (iii) | (i) | (iv) |

**98** Given below are two statements:

| | |
|---|---|
| **Statement I:** | DNA polymerases catalyse polymerisation only in one direction, that is 5' →3' |
| **Statement II:** | During replication of DNA, on one strand the replication is continuous while on other strand it is discontinuous. |

In the light of the above statements, choose the correct answer from the options given below:
1. Both **Statement I** and **Statement II** are correct.
2. Both **Statement I** and **Statement II** are incorrect.
3. **Statement I** is correct but **Statement II** is incorrect.
4. **Statement I** is incorrect but **Statement II** is correct.

**99** The Floral Diagram represents which one of the following families?



| | | | |
|---|---|---|---|
| 1. | Fabaceae | 2. | Brassicaceae |
| 3. | Solanaceae | 4. | Liliaceae |

**100** Which of the following statements is true?

| | |
|---|---|
| 1. | There is more energy and biomass each time you move up a trophic level. |
| 2. | There is less energy and biomass each time you move up a trophic level. |
| 3. | There is more energy but less biomass each time you move up a trophic level. |
| 4. | There is less energy but more biomass each time you move up a trophic level. |

**101** The number of time(s) decarboxylation of isocitrate occurs during single TCA cycle is :
1. One
2. Two
3. Three
4. Four

**102** Given below are two statements :

| | |
|---|---|
| **Statement I:** | Sickle cell anaemia and Haemophilia are autosomal dominant traits. |
| **Statement II:** | Sickle cell anaemia and Haemophilia are disorders of the blood. |

In light of the above statements, choose the correct answer from the options given below :
1. Both **Statement I** and **Statement II** are correct.
2. Both **Statement I** and **Statement II** are incorrect.
3. **Statement I** is correct but **Statement II** is incorrect.
4. **Statement I** is incorrect but **Statement II** is correct.

**103** Given below are two statements one is labelled as Assertion (A) and the other is labelled as Reason (R).

| | |
|---|---|
| **Assertion (A):** | When a particular restriction enzyme cuts strands of DNA, overhanging stretches or sticky ends are formed. |
| **Reason (R):** | Some restriction enzymes cut the strand of DNA a little away from the centre of palindromic site. |

In light of the above statements, choose the correct answer from the options given below:

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

**104** Give the correct descending order of organisms with reference to their estimated number found in Amazon forest.

| | | | |
|---|---|---|---|
| (a) | Plants | (b) | Invertebrates |
| (c) | Fishes | (d) | Mammals |
| (e) | Birds | | |

Choose the correct answer from the options given below:

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

**105** Which of the following growth regulators is an adenine derivative ?

| | | | |
|---|---|---|---|
| 1. | Auxin | 2. | Cytokinin |
| 3. | Ethylene | 4. | Abscisic acid |

**106** The type of tissue commonly found in the fruit wall of nuts is :

| | | | |
|---|---|---|---|
| 1. | Parenchyma | 2. | Collenchyma |
| 3. | Sclerenchyma | 4. | Sclereid |

**107** During decomposition, degradation of detritus into simpler inorganic substances is called:
1. Catabolism
2. Leaching
3. Chelation
4. Fragmentation

**108** In general the egg apparatus of embryo sac in angiosperm consists of:

| | |
|---|---|
| 1. | One egg cell, two synergids, three antipodal cells, two Polar nuclei |
| 2. | One egg cell, two synergids, two antipodal cells, three Polar nuclei |
| 3. | One egg cell, three synergids, two antipodal cells, two Polar nuclei |
| 4. | One egg cell, two synergids, two antipodal cells, two Polar nuclei |

**109** Match List-I with List-II

| | **List-I** | | **List-II** |
|---|---|---|---|
| (a) | Imbricate | (i) | *Calotropis* |
| (b) | Valvate | (ii) | *Cassia* |
| (c) | Vexillary | (iii) | Cotton |
| (d) | Twisted | (iv) | Bean |

Choose the correct answer from the options given below:

| | (a) | (b) | (c) | (d) |
|---|---|---|---|---|
| 1. | (ii) | (i) | (iii) | (iv) |
| 2. | (ii) | (i) | (iv) | (iii) |
| 3. | (ii) | (iv) | (iii) | (i) |
| 4. | (i) | (iii) | (iv) | (ii) |

**110** Consider the given two statements:

| | |
|---|---|
| **Assertion (A):** | Measurement of biomass in terms of fresh weight is more accurate. |
| **Reason (R):** | The standing crop is measured as the mass of living organisms (biomass) or the number in a unit area. |

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

**111** Separation of DNA, fragments is done by a technique known as :
1. Polymerase Chain Reaction
2. Recombinant technology
3. Southern blotting
4. Gel electrophoresis

**112** The phenomenon by which the undividing parenchyma cells start to divide mitotically during plant tissue culture is called as :
1. Differentiation
2. Dedifferentiation
3. Redifferentiation
4. Secondary growth

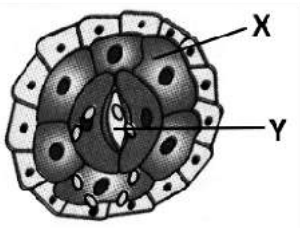
**113** In meiosis, crossing over and exchange of genetic material between homologous chromosomes are catalyzed by the enzyme.
1. Phosphorylase
2. Recombinase
3. Transferase
4. Polymerase

**114** The 5-C compound formed during TCA cycle is :
1. $\alpha-$ketoglutaric acid
2. Oxalo succinic acid
3. Succinic acid
4. Fumaric acid

**115** The World Summit on sustainable development held in 2002 in Johannesburg, South Africa pledged for:

| | |
|---|---|
| 1. | A significant reduction in the current rate of biodiversity loss. |
| 2. | Declaration of more biodiversity hotspots. |
| 3. | Increase in agricultural production |
| 4. | Collection and preservation of seeds of different genetic strains of commercially important plants. |

**116** Identify label X and Y in the given figure of stoma.




| | X | Y |
|---|---|---|
| 1. | Epidermal cell | Stoma pore |
| 2. | Accessory cell | Nucleus |
| 3. | Guard cell | Stomatal aperture |
| 4. | Subsidiary cell | Stoma pore |

**117** Which of the following statement is not correct?

| | |
|---|---|
| 1. | Rhizome is a condensed form of stem. |
| 2. | The apical bud in rhizome always remains above the ground. |
| 3. | The rhizome is aerial with no distinct nodes and internodes. |
| 4. | The rhizome is thick, prostrate and branched. |

**118** To ensure that only the desired pollens fall on the stigma in artificial hybridization process:

| | |
|---|---|
| **a:** | the female flower buds of plant producing unisexual flower need not be bagged. |
| **b:** | there is no need to emasculate unisexual flowers of selected female parent. |
| **c:** | emasculated flowers are to be bagged immediately after cross pollination. |
| **d:** | emasculated flowers are to be bagged after removal of anthers. |
| **e:** | bisexual flowers, showing protogyny are never selected for cross. |

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

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

**120** The chromosomal theory of inheritance was proposed by:
1. Thomas Morgan
2. Sutton and Boveri
3. Gregor Mendel
4. Robert Brown

**121** The ability of plants to follow different pathways in response to environment leading to formation of different kinds of structures are called :
1. Redifferentiation
2. Development
3. Plasticity
4. Differentiation

**122** Match **List-I** with **List-II**:

| | **List-I** | | **List-II** |
|---|---|---|---|
| (a) | Sacred groves | (i) | Alien species |
| (b) | Zoological park | (ii) | Release of large quantity of oxygen |
| (c) | Nile perch | (iii) | *Ex-situ* conservation |
| (d) | Amazon forest | (iv) | Khasi Hills in Meghalaya |

Choose the correct answer from the options given below:

| | (a) | (b) | (c) | (d) |
|---|---|---|---|---|
| 1. | (iv) | (iii) | (i) | (ii) |
| 2. | (ii) | (iv) | (i) | (iii) |
| 3. | (iv) | (i) | (ii) | (iii) |
| 4. | (iv) | (iii) | (ii) | (i) |

**123** Primary proteins are also known as polypeptides, because:

1. they are linear chains.
2. they are polymers of peptide monomers.
3. successive amino acids are joined by peptide bonds.
4. they can assume many conformations.

**124** Match List-I with List-II :

| | **List I** | | **List II** |
|---|---|---|---|
| (a) | Gene gun | (i) | Replacement of a faulty gene by a normal healthy gene |
| (b) | Gene therapy | (ii) | Used for transfer of gene |
| (c) | Gene cloning | (iii) | Total DNA in the cells of an organism |
| (d) | Genome | (iv) | To obtain identical copies of a particular DNA molecule |

Choose the correct answer from the options given below:

| | (a) | (b) | (c) | (d) |
|---|---|---|---|---|
| 1. | (ii) | (i) | (iv) | (iii) |
| 2. | (i) | (iii) | (ii) | (iv) |
| 3. | (iv) | (i) | (iii) | (ii) |
| 4. | (ii) | (iii) | (iv) | (i) |

**125** Match List-I with List-II

| | **List- I** | | **List-II** |
|---|---|---|---|
| (a) | Bacteriophage $\phi \times 174$ | (i) | 48502 base pairs |
| (b) | Bacteriophage lambda | (ii) | 5386 nucleotides |
| (c) | *Escherichia coli* | (iii) | $3.3 \times 10^9$ base pairs |
| (d) | Haploid content human DNA | (iv) | $4.6 \times 10^6$ base pairs of |

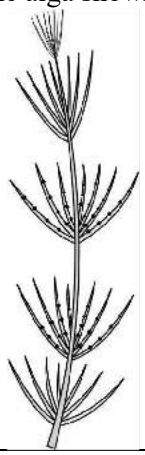
Choose the correct answer from the options given below:

| | (a) | (b) | (c) | (d) |
|---|---|---|---|---|
| 1. | (i) | (ii) | (iii) | (iv) |
| 2. | (ii) | (iv) | (i) | (iii) |
| 3. | (ii) | (i) | (iv) | (iii) |
| 4. | (i) | (ii) | (iv) | (iii) |

**126** Which of the following can be expected if scientists succeed in introducing apomictic gene into hybrid varieties of crops?

| | |
|---|---|
| 1. | Polyembryony will be seen and each seed will produce many plantlets. |
| 2. | Seeds of hybrid plants will show longer dormancy. |
| 3. | Farmers can keep on using the seeds produced by the hybrids to raise new crop year after year. |
| 4. | There will be segregation of the desired characters only in the progeny. |

**127** Read the following statements and identify the characters related to the alga shown in the diagram:



| | |
|---|---|
| **a.** | It is a member of Chlorophyceae. |
| **b.** | Food is stored in the form of starch. |
| **c.** | It is a monoecious plant showing oogonium and antheridium. |
| **d.** | Food is stored in the form of laminarin or mannitol. |
| **e.** | It shows dominance of pigments chlorophyll a, c and Fucoxanthin. |

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

**128** Frugivorous birds are found in large numbers in tropical forests mainly because of :
1. lack of niche specialisation.
2. higher annual rainfall.
3. availability of fruits throughout the year.
4. temperature conducive for their breeding.

**129** Which type of substances would face difficulty in passing through the cell membrane?

| | |
|---|---|
| 1. | Substances with hydrophobic moiety |
| 2. | Substances with hydrophilic moiety |
| 3. | All substances, irrespective of hydrophobic and hydrophilic moiety |
| 4. | Substances which are soluble in lipids |

**130** Identify the correct statements regarding chemiosmotic hypothesis:

| | |
|---|---|
| (a) | Splitting of the water molecule takes place on the inner side of the membrane. |
| (b) | Protons accumulate within the lumen of the thylakoids. |
| (c). | The primary acceptor of electrons transfers the electrons to an electron carrier. |
| (d) | NADP reductase enzyme is located on the stroma side of the membrane. |
| (e) | Protons increase in number in stroma. |

Choose the correct answer from the options given below:

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

**131** If a female individual is with small round head, furrowed tongue, partially open mouth and broad palm with characteristic palm crease. Also the physical, psychomotor and mental development is retarded. The karyotype analysis of such an individual will show :
1. 47 chromosomes with XXY sex chromosomes
2. 45 chromosomes with XO sex chromosomes
3. 47 chromosomes with XYY sex chromosomes
4. Trisomy of chromosome 21

**132** Identify the correct sequence of events during Prophase I of meiosis:

| | |
|---|---|
| a. | Synapsis of homologous chromosomes |
| b. | Chromosomes become gradually visible under a microscope |
| c. | Crossing over between non-sister chromatids of homologous chromosomes |
| d. | Terminalisation of chiasmata |
| e. | Dissolution of synaptonemal complex |

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

**133** The enzyme (a) is needed for isolating genetic material from plant cells and enzyme (b) for isolating genetic material from fungus. Choose the correct pair of options from the following :
1. (a) Cellulase (b) Protease
2. (a) Cellulase (b) Chitinase
3. (a) Chitinase (b) Lipase
4. (a) Cellulase (b) Lipase

**134** Match the List-I with List-II

| | **List-I** | | **List-II** |
|---|---|---|---|
| (a) | Carbon dissolved in oceans | (i) | 55 billion tons |
| (b) | Annual fixation of carbon through photosynthesis | (ii) | 71% |
| (c) | PAR captured by plants | (iii) | $4 \times 10^3$kg |
| (d) | Productivity of oceans | (iv) | 2 to 10% |

Choose the correct answer from the options given below:

| | (a) | (b) | (c) | (d) |
|---|---|---|---|---|
| 1. | (ii) | (iv) | (iii) | (i) |
| 2. | (iii) | (iv) | (ii) | (i) |
| 3. | (ii) | (iii) | (iv) | (i) |
| 4. | (iii) | (ii) | (i) | (iv) |

**135** What is the expected percentage of $F_2$ progeny with yellow and inflated pod in dihybrid cross experiment involving pea plants with green coloured, inflated pod and yellow coloured constricted pod ?
1. 100%
2. 56.25%
3. 18.75 %
4. 9%

**136** Pathogenic bacteria gain resistance to antibiotics due to changes in their :
1. Cosmids
2. Plasmids
3. Nucleus
4. Nucleoid

**137** Milk of transgenic 'Cow Rosie' was nutritionally more balanced product for human babies than natural cow milk because it contained:
1. Human protein $\alpha$ –1–antitrypsin.
2. Human alpha–lactalbumin.
3. Human insulin–like growth factor.
4. Human enzyme Adenosine Deaminase (ADA).

**138** If the pH in lysosomes is increased to alkaline, what will be the outcome?

| | |
|---|---|
| 1. | Hydrolytic enzymes will function more efficiently |
| 2. | Hydrolytic enzymes will become inactive |
| 3. | Lysosomal enzymes will be released into the cytoplasm |
| 4. | Lysosomal enzymes will be more active |

**139** Which of the following reasons is mainly responsible for graft rejection in transplantation of organs?

| | |
|---|---|
| 1. | Inability of recipient to differentiate between 'self and 'non–self' tissues/cells |
| 2. | Humoral immune response only |
| 3. | Auto–immune response |
| 4. | Cell–mediated response |

**140** If DNA contained sulphur instead of phosphorus and proteins contained phosphorus instead of sulfur, what would have been the outcome of Hershey and Chase experiment?

| | |
|---|---|
| 1. | No radioactive sulfur in bacterial cells |
| 2. | Both radioactive sulfur and phosphorus in bacterial cells |
| 3. | Radioactive sulfur in bacterial cells |
| 4. | Radioactive phosphorus in bacterial cells |

**141** Two butterfly species are competing for the same nectar of a flower in a garden. To survive and coexist together, they may avoid competition in the same garden by:
1. feeding at the same time.
2. choosing different foraging patterns.
3. increasing time spent on attacking each other.
4. predating on each other.

**142** Mad cow disease in cattle and Cr Jacob disease in humans are due to infection by_____ .
1. Bacterium
2. Virus
3. Viroid
4. Prion

**143** Which of the following is not an Intra Uterine Device?
1. Progestogens
2. Multiload 375
3. Lippes loop
4. Progestasert

**144** According to the sliding filament theory:

| | |
|---|---|
| 1. | Actin and myosin filaments slide over each other to increase the length of the sarcomere. |
| 2. | Length of A–band does not change. |
| 3. | I–band increases in length |
| 4. | The actin filaments slide away from A–band resulting in shortening of sarcomere |

**145** The amount of biomass or organic matter produced per unit area over a time period by plants during photosynthesis is called:
1. Secondary production
2. Primary production
3. Gross primary production
4. Net primary production

**146** Given below are two statements:

| | |
|---|---|
| **Statement I:** | Amino acids have a property of ionizable nature of $–NH_2$ and –COOH groups, hence have different structures at different pH. |
| **Statement II:** | Amino acids can exist as Zwitterionic form at acidic and basic pH. |

In the light of the above statements, choose the most appropriate answer from the options given below:

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

**147** Which of the following types of epithelium is present in the bronchioles and Fallopian tubes?
1. Simple squamous epithelium
2. Simple columnar epithelium
3. Ciliated epithelium
4. Stratified squamous epithelium

**148** Western Ghats have a large number of plants and animal species that are not found anywhere else. Which of the following term is used to notify such species?
1. Threatened species
2. Keystone species
3. Endemic species
4. Vulnerable species

**149** Gout is a type of disorder which leads to:

| | |
|---|---|
| 1. | Inflammation of joints due to accumulation of uric acid crystals |
| 2. | Weakening of bones due to decreased bone mass |
| 3. | Inflammation of joints due to cartilage degeneration |
| 4. | Weakening of bones due to low calcium level |

**150** Which of the following statements are correct with respect to vital capacity?

| | |
|---|---|
| (a) | It includes ERV, TV and IRV |
| (b) | Total volume of air a person can inspire after a normal expiration |
| (c) | The maximum volume of air a person can breathe in after forced expiration |
| (d) | It includes ERV, RV and IRV. |
| (e) | The maximum volume of air a person can breathe out after a forced inspiration. |

Choose the most appropriate answer from the options given below:

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

**151** A unique vascular connection between the digestive tract and liver is called _____ .
1. Hepato–pancreatic system
2. Hepatic portal system
3. Renal portal system
4. Hepato–cystic system

**152** Match List-I with List-II regarding the organs of cockroach:

| | **List I** | | **List II** |
|---|---|---|---|
| (a) | Crop | (i) | grinding the food particles |
| (b) | Proventriculus | (ii) | secretion of digestive juice |
| (c) | Hepatic caecae | (iii) | removal of nitrogenous waste |
| (d) | Malpighian tubules | (iv) | storage of food |

Choose the correct answer from the options given below:

| | (a) | (b) | (c) | (d) |
|---|---|---|---|---|
| 1. | (iv) | (i) | (ii) | (iii) |
| 2. | (iii) | (ii) | (i) | (iv) |
| 3. | (ii) | (iv) | (i) | (iii) |
| 4. | (i) | (iv) | (iii) | (ii) |

**153** Consider the given two statements:

| | |
|---|---|
| **Assertion (A):** | *Alternaria solani* belongs to the fungal class deuteromycetes. |
| **Reason (R):** | Sexual stages in the life cycle of *Alternaria solani* are not known yet. |

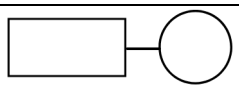
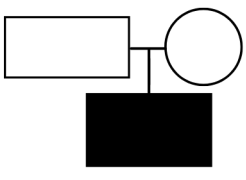
| | |
|---|---|
| 1. | Both **(A)** and **(R)** are True and **(R)** correctly explains **(A)** |
| 2. | Both **(A)** and **(R)** are True but **(R)** does not correctly explain **(A)** |
| 3. | **(A)** is True, **(R)** is False |
| 4. | **(A)** is False, **(R)** is True |

**154** Panspermia, an idea that is still a favorite for some astronomers, means:

| | |
|---|---|
| 1. | Creation of life from dead and decaying matter |
| 2. | Creation of life from chemicals |
| 3. | Origin of sperm in human testes |
| 4. | Transfer of spores as a unit of life from other planets of Earth |

**155** Arrange the components of the mammary gland. (from proximal to distal)
(a) Mammary duct
(b) Lactiferous duct
(c) Alveoli
(d) Mammary ampulla
(e) Mammary tubules
Choose the most appropriate answer from the options given below :
1. (c) → (a) → (d) → (e) → (b)
2. (b) → (c) → (e) → (d) → (a)
3. (c) → (e) → (a) → (d) → (b)
4. (e) → (c) → (d) → (b) → (a)

**156** Select the incorrect match regarding the symbols used in Pedigree analysis:

| | | |
|---|---|---|
| 1. |  | Sex unspecified |
| 2. |  | Affected individual |
| 3. |  | Consanguineous mating |
| 4. |  | Parent with male child affected with disease |

**157** Which of the following methods is not used, commonly, for introducing foreign DNA into the plant cell?
1. Agrobacterium mediated transformation
2. Gene gun
3. 'Disarmed pathogen' vectors
4. Bacteriophages

**158** Identify the region of human brain which has pneumotaxic centre that alters respiratory rate by reducing the duration of inspiration.

| | | | |
|---|---|---|---|
| 1. | Medulla | 2. | Pons |
| 3. | Thalamus | 4. | Cerebrum |

**159** How many secondary spermatocytes are required to form 400 million spermatozoa?
1. 50 million
2. 100 million
3. 200 million
4. 400 million

**160** Choose the correct statement about a muscular tissue:

| | |
|---|---|
| 1. | Skeletal muscle fibres are uninucleated and found in parallel bundles. |
| 2. | Intercalated discs allow the cardiac muscle cells to contract as a unit. |
| 3. | The walls of blood vessels are made up of columnar epithelium. |
| 4. | Smooth muscles are multinucleated and involuntary |

**161** Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).

| | |
|---|---|
| **Assertion (A):** | FSH which interacts with membrane bound receptors does not enter the target cell. |
| **Reason (R):** | Binding of FSH to its receptors generates second messenger (cyclic AMP) for its biochemical and physiological responses. |

In the light of the above statements, choose the most appropriate answer from the options given below:

| | |
|---|---|
| 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. |

**162** Which of the following animals has three chambered heart?

| | | | |
|---|---|---|---|
| 1. | *Scoliodon* | 2. | *Hippocampus* |
| 3. | *Chelone* | 4. | *Pteropus* |

**163** Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).

| | |
|---|---|
| **Assertion (A):** | Pregnancy is characterised by metabolic changes in the mother. |
| **Reason (R):** | During pregnancy, the level of thyroxine is increased in the maternal blood. |

In the light of the above statements, choose the most appropriate answer from the options given below:

| | |
|---|---|
| 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. |

**164** Select the incorrect statements with respect to Cyclostomes:
**(a)** They lack scales and paired fins.
**(b)** They have circular mouth with jaws.
**(c)** They bear 6-15 pairs of gills.
**(d)** They migrate to deep sea for spawning.
Choose the most appropriate answer from the options given below:
1. **(a)** and **(b)** only
2. **(b)** and **(c)** only
3. **(b)** and **(d)** only
4. **(a)** and **(d)** only

**165** Choose the correct statements :

| | |
|---|---|
| (a) | Bones support and protect softer tissues and organs |
| (b) | Weight bearing function is served by limb bones |
| (c) | Ligament is the site of production of blood cells |
| (d) | Adipose tissue is specialised to store fats |
| (e) | Tendons attach one bone to another |

Choose the most appropriate answer from the options given below :

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

**166** Bivalent or Tetrad formation is a characteristic feature observed during :
1. Synaptonemal complex in the zygotene stage
2. Chiasmata in the diplotene stage
3. Synaptonemal complex in the pachytene stage
4. Chiasmata in the zygotene stage

**167** Given below are two statements:

| | |
|---|---|
| **Assertion (A):** | *Petunia* and *Datura* show some similarities |
| **Reason (R):** | *Petunia* and *Datura* are placed in the same family Brassicaceae |

| | |
|---|---|
| 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. |

**168** A normal girl, whose mother is haemophilic marries a male with no ancestral history of haemophilia. What will be the possible phenotypes of the offsprings?

| | |
|---|---|
| (a) | Haemophilic son and haemophilic daughter. |
| (b) | Haemophilic son and carrier daughter. |
| (c) | Normal daughter and normal son. |
| (d) | Normal son and haemophilic daughter. |

Choose the most appropriate answer from the options given below:
1. (a) and (b) only
2. (b) and (c) only
3. (a) and (d) only
4. (b) and (d) only

**169** IUDs are small objects made up of plastic or copper that are inserted in the uterine cavity. Which of the following statements are correct about IUDs ?

| | |
|---|---|
| (a) | IUDs decrease phagocytosis of sperm within the uterus. |
| (b) | The released copper ions suppress sperm motility. |
| (c) | IUDs do not make the cervix hostile to the sperm. |
| (d) | IUDs suppress the fertilization capacity of sperm. |
| (e) | The IUDs require surgical intervention for their insertion in the uterine cavity. |

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

**170** Refer to the following statements for agarose-gel electrophoresis:

| | |
|---|---|
| (a) | Agarose is a natural polymer obtained from sea-weed. |
| (b) | The separation of DNA molecules in agarose-gel electrophoresis depends on the size of DNA. |
| (c) | The DNA migrates from negatively-charged electrode to the positively-charged electrode. |
| (d) | The DNA migrates from positively-charged electrode to the negatively-charged electrode. |

Choose the most appropriate answer from the options given below :

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

**171** Match List-I with List-II

| | **List-I** | | **List-II** |
|---|---|---|---|
| (a) | Multipolar neuron | (i) | Somatic neural system |
| (b) | Bipolar neuron | (ii) | Cerebral cortex |
| (c) | Myelinated nerve fibre | (iii) | Retina of Eye |
| (d) | Unmyelinated nerve fibre | (iv) | Spinal nerves |

Choose the correct answer from the options given below:

| | (a) | (b) | (c) | (d) |
|---|---|---|---|---|
| 1. | (iii) | (i) | (iv) | (ii) |
| 2. | (ii) | (iv) | (iii) | (i) |
| 3. | (ii) | (iii) | (i) | (iv) |
| 4. | (ii) | (iii) | (iv) | (i) |

**172** Excretion in cockroach is performed by all, EXCEPT :
1. Uricose glands
2. Malpighian tubules
3. Fat body
4. Hepatic caeca

**173** Select the correct statement regarding the mutation theory of evolution:

| | |
|---|---|
| 1. | This theory was proposed by Alfred Wallace. |
| 2. | Variations are small directional changes. |
| 3. | Single-step large mutation is a cause of speciation. |
| 4. | Large differences due to mutations arise gradually in a population. |

**174** Arrange the following formed elements in the decreasing order of their abundance in blood in humans :
(a) Platelets
(b) Neutrophils
(c) Erythrocytes
(d) Eosinophils
(e) Monocytes
Choose the most appropriate answer from the options given below :
1. (c), (a), (b), (e), (d)
2. (c), (b), (a), (e), (d)
3. (d), (e), (b), (a), (c)
4. (a), (c), (b), (d), (e)

**175** In the enzyme which catalyses the breakdown of:
$H_2O_2 \rightarrow H_2O + O_2$
the prosthetic group is :
1. Nicotinamide adenine dinucleotide
2. Haem
3. Zinc
4. Niacin

**176** Against the codon 5' UAC 3', what would be the sequence of anticodon on tRNA ?
1. 5' AUG 3'
2. 5' ATG 3'
3. 5' GTA 3'
4. 5' GUA 3

**177** Select the correct statements.

| | |
|---|---|
| (a) | Angiotensin II activates the cortex of adrenal gland to release aldosterone. |
| (b) | Aldosterone leads to increase in blood pressure. |
| (c) | ANF acts as a check on renin-angiotensin mechanism. |
| (d) | ADH causes vasodilation. |
| (e) | Vasopressin is released from adenohypophysis. |

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

**178** With respect to metaphase, which of the following statements is incorrect ?

| | |
|---|---|
| 1. | Complete disintegration of nuclear envelope takes place. |
| 2. | Chromosomes are highly condensed. |
| 3. | Metaphase chromosomes are made up of four sister chromatids held together by centromere. |
| 4. | Chromosomes lie at the equator of the cell. |

**179** Match List-I with List-II:

| | **List-I** | | **List-II** |
|---|---|---|---|
| (a) | Cellular barrier | (i) | Interferons |
| (b) | Cytokine barrier | (ii) | Mucus |
| (c) | Physical barrier | (iii) | Neutrophils |
| (d) | Physiological barrier | (iv) | HCI in gastric juice |

Choose the correct answer from the options given below:

| | (a) | (b) | (c) | (d) |
|---|---|---|---|---|
| 1. | (ii) | (iii) | (iv) | (i) |
| 2. | (ii) | (iii) | (i) | (iv) |
| 3. | (iii) | (iv) | (ii) | (i) |
| 4. | (iii) | (i) | (ii) | (iv) |

**180** If A and C make 30% and 20% of DNA, respectively, what will be the percentage composition of T and G ?
1. T : 20%, G : 30%
2. T : 30%, G : 20%
3. T : 30%, G : 30%
4. T : 20%, G : 20%