

Physics
Section - A

1. A long solenoid of radius 1 mm has 100 turns per mm. If 1 A current flows in the solenoid, the magnetic field strength at the centre of the solenoid is:

- (1) 12.56×10^{-2} T
- (2) 12.56×10^{-4} T
- (3) 6.28×10^{-4} T
- (4) 6.28×10^{-2} T

Sol. (1)

$$B = \mu_0 n i = \mu_0 \frac{N}{\ell} i$$

$$\therefore B = 4\pi \times 10^{-7} \times 1 = 12.56 \times 10^{-2} \text{ T}$$

2. A biconvex lens has radii of curvature, 20 cm each. If the refractive index of the material of the lens is 1.5, the power of the lens is:

- (1) +20 D
- (2) +5D
- (3) infinity
- (4) +2D

Sol. (2)

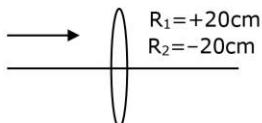
$$f = \frac{R}{2(\mu - 1)}$$

$$\frac{20}{2(1.5 - 1)} = \frac{10}{1/2}$$

$$f = 20 \text{ cm}$$

$$p = 100/f$$

$$= 100/20 = 5 \text{ D}$$



3. Let T_1 and T_2 be the energy of an electron in the first and second excited states of hydrogen atom, respectively. According to the Bohr's model of an atom, the ratio $T_1 : T_2$ is :

- (1) 4 : 1
- (2) 4 : 9
- (3) 9 : 4
- (4) 1 : 4

Sol. (3)

First excited state $\Rightarrow n = 2$

$$T_1 = -13.6 \frac{Z^2}{n^2} = -\frac{13.6}{4} \text{ eV}$$

Second excited state $\Rightarrow n = 3$

$$T_2 = -13.6 \frac{Z^2}{n^2} = -\frac{13.6}{9} \text{ eV}$$

$$T_1 : T_2 = \frac{1}{4} : \frac{1}{9} = 9 : 4$$

4. The peak voltage of the ac source is equal to:

- (1) the rms value of the ac source
- (2) $\sqrt{2}$ times the rms value of the ac source
- (3) $1/\sqrt{2}$ times the rms value of the ac source
- (4) the value of voltage supplied to the circuit.

Sol. (2)

Peak voltage is $\sqrt{2}$ times rms voltages in ac.

5. Match List-I with List-II :

List - I

(Electromagnetic waves)

- (a) AM radio waves
- (b) Microwaves
- (c) Infrared radiations
- (d) X-rays

List - II

(Wavelength)

- (i) 10^{-10} m
- (ii) 10^2 m
- (iii) 10^{-2} m
- (iv) 10^{-4} m

Choose the correct answer from the options given below:

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

Sol. (3)

- (a) AM radio wave $\approx 10^2 \text{ m}$ (ii)
- (b) Microwave $\approx 10^{-2} \text{ m}$ (iii)
- (c) Infrared radiations (iv) $\approx 10^{-4} \text{ m}$ (iv)
- (d) X-ray $\approx \text{\AA} = 10^{-10} \text{ m}$ (i)

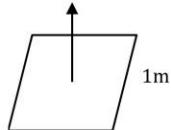
- (a) - (ii), (b) - (iii), (c) - (iv), (d) - (i)

6. A square loop of side 1m and resistance 1Ω is placed in a magnetic field of 0.5T . If the plane of loop is perpendicular to the direction of magnetic field, the magnetic flux through the loop is :

- (1) 0.5 weber
- (2) 1 weber
- (3) zero weber
- (4) 2 weber

Sol. (1)

$$B = 0.5\text{T}$$



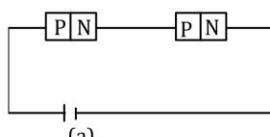
Angle between \vec{B} & \vec{A} zero

$$\phi = B \cdot A \cos 0$$

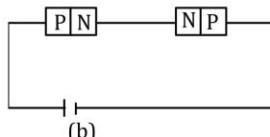
$$= 0.5 \times 1 \times 1$$

$$= 0.5 \text{ wb}$$

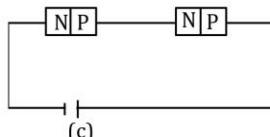
7.



(a)



(b)



(c)

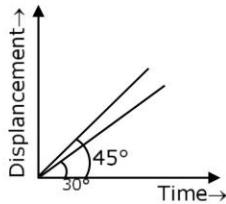
In the given circuits (a), (b) and (c), the potential drop across the two p-n junctions are equal in :

- (1) Circuit (b) only
- (2) Circuit (c) only
- (3) Both circuits (a) and (c)
- (4) Circuit (a) only

Sol. (3)

In (a) & (c) circuits, both the junctions are in same biasing conditions so offers equal resistances. Since both are in series, therefore equal potential will drop across the junction.

8. The displacement-time graphs of two moving particles make angles of 30° and 45° with the x-axis as shown in the figure. The ratio of their respective velocity is :



- (1) 1 : 1
- (2) 1 : 2
- (3) 1 : $\sqrt{3}$
- (4) $\sqrt{3} : 1$

Sol. (3)

Velocity is slope of x-t graph

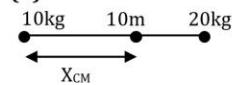
$$V = \frac{dx}{dt} = \tan\theta$$

$$\frac{V_1}{V_2} = \frac{\tan\theta_1}{\tan\theta_2} = \frac{\tan 30^\circ}{\tan 45^\circ} = \frac{1}{\sqrt{3}}$$

9. Two objects of mass 10kg and 20kg respectively are connected to the two ends of a rigid rod of length 10m with negligible mass. The distance of the center of mass of the system from the 10kg mass is :

- (1) $\frac{20}{3}$ m
- (2) 10m
- (3) 5m
- (4) $\frac{10}{3}$ m

Sol. (1)



$$X_{CM} = \frac{20 \times 10}{20 + 10} = \frac{20}{3} \text{ m}$$

- 10.** The angle between the electric lines of force and the equipotential surface is :
(1) 45° (2) 90° (3) 180° (4) 0°

Sol. (2)

Electric field is always perpendicular to EPS.

11. If the initial tension on a stretched string is doubled, then the ratio of the initial and final speeds of a transverse waves along the string is:

(1) $\sqrt{2} : 1$ (2) $1 : \sqrt{2}$ (3) $1 : 2$ (4) $1 : 1$

Sol. (2)

$$V \propto \sqrt{\text{Tension}}$$

$$\frac{v_i}{v_f} = \sqrt{\frac{T_i}{T_f}}$$

$$\frac{v_i}{v_f} = \sqrt{\frac{T}{2T}}$$

$$\frac{v_i}{v_f} = \sqrt{\frac{1}{2}} = \frac{1}{\sqrt{2}}$$

12. When two monochromatic lights of frequency, ν and $\frac{\nu}{2}$ are incident on a photoelectric metal, their stopping potential becomes $\frac{V_s}{2}$ and V_s respectively. The threshold frequency for this metal is :

(1) 3 v

$$(2) \frac{2}{3} v$$

$$(3) \frac{3}{2} v$$

(4) 2 v

Sol. (3)

$$h\nu = w + \frac{ev_s}{2}$$

$$\frac{hv}{2} = w + ev_s$$

$$2hv - hv/2 = 2w - w$$

$$\frac{3hv}{2} = w$$

$$\frac{3kv}{2} = kv_{th}$$

$$v_{th} = \frac{3v}{2}$$

Answer is correct but it is not practically possible.

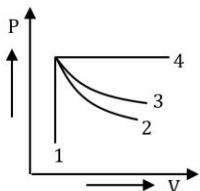
- 13.** As the temperature increases, the electrical resistance:
(1) decreases for both conductors and semiconductors
(2) increases for conductors but decreases for semiconductors
(3) decreases for conductors but increases for semiconductors
(4) increases for both conductors and semiconductors

Sol. (2)

For conductors α is (+) ve

For semiconductors & Insulators α is (-)ve

- 14.** An ideal gas undergoes four different processes from the same initial state as shown in the figure below. Those processes are adiabatic, isothermal, isobaric and isochoric. The curve which represents the adiabatic process among 1, 2, 3 and 4 is :



- (1) 2
(2) 3
(3) 4
(4) 1

Sol. (1)

1 : Isochoric
2 : Adiabatic
3 : Isothermal
4 : Isobaric

- 15.** The energy that will be ideally radiated by a 100 kW transmitter in 1 hour is :

- (1) 36×10^4 J
(2) 36×10^5 J
(3) 1×10^5 J
(4) 36×10^7 J

Sol. (4)

$$\begin{aligned} E &= P \times t = 100 \times 10^3 \times 3600 \\ &= 36 \times 10^7 \text{ J} \end{aligned}$$

- 16.** The ratio of the distances travelled by a freely falling body in the 1st, 2nd, 3rd and 4th second :
 (1) 1 : 4 : 9 : 16 (2) 1 : 3 : 5 : 7 (3) 1 : 1 : 1 : 1 (4) 1 : 2 : 3 : 4

Sol. (2)

$$\begin{aligned} S_{\text{nth}} &= u + \frac{a}{2}(2n - 1) \\ &= 0 + \frac{a}{2}(2n - 1) \\ S_{\text{nth}} &\propto (2n - 1) \\ \Rightarrow S_{1\text{st}}, S_{2\text{nd}}, S_{3\text{rd}}, S_{4\text{th}} \\ &= [2(1) - 1] : [2(2) - 1] : [2(3) - 1] : [2(4) - 1] \\ &= 1 : 3 : 5 : 7 \end{aligned}$$

- 17.** Given below are two statements :

Statement I : Biot-Savart's law gives us the expression for the magnetic field strength of an infinitesimal current element (Idl) of a current carrying conductor only.
Statement II : Biot-Savart's law is analogous to Coulomb's inverse square law of charge q , with the former being related to the field produced by a scalar source, Idl while the latter being produced by a vector source, q .

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

- (1) Both **Statement I** and **Statement II** are incorrect
- (2) **Statement I** is correct and **Statement II** is incorrect
- (3) **Statement I** is incorrect and **Statement II** is correct
- (4) Both **Statement I** and **Statement II** are correct

Sol. (2)

$$d\vec{B} = \frac{\mu_0 (Id\vec{l} \times \vec{r})}{4\pi r^3}$$

As per Biot Savart law, the expression for magnetic field depends on current carrying element $Id\vec{l}$, which is a vector quantity, therefore, statement-I is correct and statement-II is wrong.

- 18.** When light propagates through a material medium of relative permittivity ϵ_r and relative permeability μ_r , the velocity of light v is given by : (c : velocity of light in vacumm)

$$(1) v = \sqrt{\frac{\mu_r}{\epsilon_r}} \quad (2) v = \sqrt{\frac{\epsilon_r}{\mu_r}} \quad (3) v = \frac{c}{\sqrt{\epsilon_r \mu_r}} \quad (4) v = c$$

Sol. (3)

$$n = \sqrt{\epsilon_r \mu_r}$$

$$n = \frac{c}{v} \Rightarrow v = \frac{c}{n}$$

$$v = \left(\frac{c}{\sqrt{\epsilon_r \mu_r}} \right)$$

- 19.** A body of mass 60g experiences a gravitational force of 3.0N, when placed at a particular point. The magnitude of the gravitational field intensity at that point is :

(1) 50 N/kg (2) 20 N/kg (3) 180 N/kg (4) 0.05 N/kg

Sol. **(1)**

$$I_g = \frac{F}{m}$$

$$= \frac{3}{60 \times 10^{-3}} = 50 \text{ N/kg}$$

- 20.** In half wave rectification, if the input frequency is 60Hz then the output frequency would be :

(1) 30Hz (2) 60Hz (3) 120 Hz (4) zero

Sol. **(2)**

In half wave rectification

$$F_{\text{in}} = F_{\text{out}}$$

$$\Rightarrow F_{\text{out}} = 60 \text{ Hz}$$

- 21.** If a soap bubble expands, the pressure inside the bubble:

(1) increases (2) remains the same
 (3) is equal to the atmospheric pressure (4) decreases

Sol. **(4)**

$$\Delta P = \frac{4T}{R}$$

$$P_{\text{in}} = P_{\text{out}} = \frac{4T}{R}$$

If soap bubble expands

R will increase

P_{in} will decrease.

- 22.** The ratio of the radius of gyration of a thin uniform disc about an axis passing through its centre and normal to its plane to the radius of gyration of the disc about its diameter is :

(1) $\sqrt{2} : 1$ (2) 4 : 1 (3) $1 : \sqrt{2}$ (4) 2 : 1

Sol. **(1)**

$$\frac{MR^2}{2} = MK_1^2$$

$$\frac{MR^2}{4} = MK_2^2$$

$$\frac{4}{2} = \frac{K_1^2}{K_2^2}$$

$$\frac{K_1}{K_2} = \sqrt{\frac{2}{1}}$$

23. Two hollow conducting spheres of radii R_1 and R_2 ($R_1 \gg R_2$) have equal charges. The potential would be:
 (1) more on smaller sphere
 (2) equal on both the spheres
 (3) dependent on the material property of the sphere
 (4) more on bigger sphere

Sol. (1)

$$V = \frac{kQ}{R}$$

$$V_1 = \frac{kQ}{R_1}; V_2 = \frac{kQ}{R_2}$$

$$R_1 \gg R_2$$

$$\text{Then } V_1 \ll V_2$$

Smaller sphere has more potential.

24. Plane angle and solid angle have:
 (1) Dimensions but no units
 (2) No units and no dimensions
 (3) Both units and dimensions
 (4) Units but no dimensions

Sol. (4)

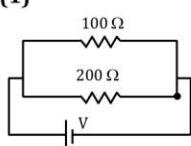
Unit of angle – radian

Unit of solid angle – steradian

But both are dimensionless

25. Two resistors of resistance, 100Ω and 200Ω are connected in parallel in an electrical circuit. The ratio of the thermal energy developed in 100Ω to that in 200Ω in a given time is :
 (1) 2 : 1
 (2) 1 : 4
 (3) 4 : 1
 (4) 1 : 2

Sol. (1)



$$P = \frac{V^2}{R} \quad V = \text{same in parallel}$$

$$\frac{P_1}{P_2} = \frac{R_2}{R_1} = \frac{200}{100} = \frac{2}{1}$$

26. The angular speed of a fly wheel moving with uniform angular acceleration changes from 1200 rpm to 3120 rpm in 16 second. The angular acceleration in rad/s^2 is :

- (1) 4π
- (2) 12π
- (3) 104π
- (4) 2π

Sol. (1)

$$f_0 = \frac{1200}{60} = 20 \text{ Hz}$$

$$\omega_0 = 2\pi f_0 = 40\pi \text{ rad}$$

$$f = \frac{3120}{60} = 50 \text{ Hz}$$

$$\omega = 2\pi f = 104\pi \text{ rad}$$

$$t = 16 \text{ s}$$

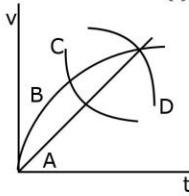
$$\omega = \omega_0 + \alpha t$$

$$104\pi = 40\pi + \alpha(16)$$

$$\frac{64\pi}{16} = \alpha$$

$$\alpha = 4\pi$$

27. A spherical ball is dropped in a long column of a highly viscous liquid. The curve in the graph shown, which represents the speed of the ball (v) as a function of time (t) is :



- (1) B
- (2) C
- (3) D
- (4) A

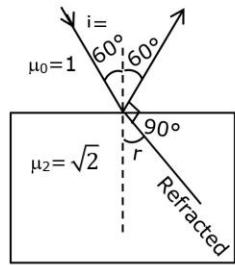
Sol. (1)

As ball is falling vertically downward at first velocity increases then become equal to terminal velocity (constant).

28. A light ray falls on a glass surface of refractive index $\sqrt{3}$, at an angle 60° . The angle between the refracted and reflected rays would be :

- (1) 60°
- (2) 90°
- (3) 120°
- (4) 30°

Sol. (2)



$$\mu_1 \sin I = \mu_2 \sin r$$

$$1 \times \frac{\sqrt{3}}{2} = \sqrt{2} \sin r$$

$$\sin r = \frac{1}{2}$$

$$r = 30^\circ$$

29. An electric lift with a maximum load of 2000 kg (lift + passengers) is moving up with a constant speed of 1.5 ms^{-1} . The frictional force opposing the motion is 3000N. The minimum power delivered by the motor to the lift in watts is : ($g = 10 \text{ ms}^{-2}$)

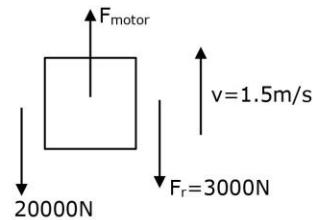
(1) 20000

(2) 34500

(3) 23500

(4) 23000

Sol. (2)



$$P = f_m \cdot v$$

$$= (20000 + 3000) = 1.5$$

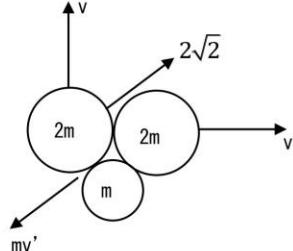
$$= 23000 \times 1.5$$

$$= 34500 \text{ watt}$$

30. A shell of mass m is at rest initially. It explodes into three fragments having equal mass in the ratio 2:2:1. If the fragments having equal mass fly off along mutually perpendicular directions with speed v , the speed of the third (lighter) fragment is:

- (1) $\sqrt{2}v$
- (2) $2\sqrt{2}v$
- (3) $3\sqrt{2}v$
- (4) v

Sol. (2)



$$mv' = 2\sqrt{2} mv$$

$$v' = 2\sqrt{2} v$$

31. The dimensions $[MLT^{-2}A^{-2}]$ belong to the :

- (1) self inductance
- (2) magnetic permeability
- (3) electric permittivity
- (4) magnetic flux

Sol. (2)

As we know

$$\frac{dF}{d\ell} = \frac{\mu_0 i_1 i_2}{2\pi d}$$

$$\begin{aligned}\therefore \mu_0 &= \left(\frac{dF}{d\ell} \right) \left(\frac{2\pi d}{i_1 i_2} \right) \\ &= \frac{[MLT^{-2}][L]}{[L][A^2]} \\ &= [MLT^{-2}A^{-2}]\end{aligned}$$

32. A copper wire of length 10 m and radius $\left(\frac{10^{-2}}{\sqrt{\pi}}\right)^m$ has electrical resistance of 10Ω . The current density in the wire for an electric field strength of $10(V/m)$ is:
 (1) $10^6 A/m^2$ (2) $10^{-5} A/m^2$ (3) $10^5 A/m^2$ (4) $10^4 A/m^2$

Sol. (3)

$$\ell = 10\text{m}$$

$$R = \frac{10^{-2}}{\sqrt{\pi}} \text{ m}$$

$$R = 10\Omega$$

$$E = 10 \frac{\text{V}}{\text{m}}$$

As we know

$$J = \sigma E = \frac{E}{\rho}$$

$$\text{Now, } R = \frac{\rho \ell}{A}$$

$$\therefore \rho = \frac{RA}{\ell}$$

$$\text{Hence, } J = \frac{E \ell}{RA}$$

$$\text{Now, } A = \pi r^2 = \pi \frac{(10^{-2})^2}{\pi} = 10^{-4} \text{ m}^2$$

$$\therefore J = \frac{10 \times 10}{10 \times 10^{-4}} = 10^5 \text{ A/m}^2$$

33. In a Young's double slit experiment, a student observes 8 fringes in a certain segment of screen when a monochromatic light of 600 nm wavelength is used. If the wavelength of light is changed to 400 nm, then number of fringes he would observe in the same region of the screen is:

(1) 8

(2) 9

(3) 12

(4) 6

Sol. (3)

$$N_1 B_1 = n_2 B_2$$

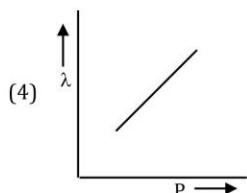
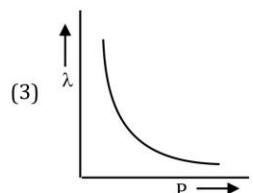
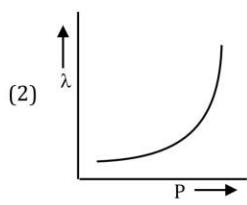
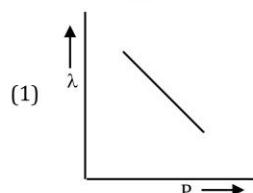
$$n_1 \frac{\lambda_1 D}{d} = n_2 \frac{\lambda_2 D}{d}$$

$$\therefore n_1 L_1 = n_2 L_2$$

$$8 \times 600 = n_2 \times 400$$

$$n_2 = \frac{4800}{400} = 12$$

- 34.** The graph which shows the variation of the de Broglie wavelength (λ) of a particle and its associated momentum (p) is:



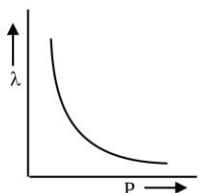
Sol. (3)

According to de Broglie

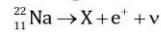
$$\lambda = \frac{h}{p}$$

$$\lambda \cdot p = \text{constant}$$

Hence, graph will be hyperbola



- 35.** In the given nuclear reaction, the element X is :



$$(1) {}^{23}_{10}\text{Ne}$$

$$(2) {}^{22}_{10}\text{Ne}$$

$$(3) {}^{22}_{12}\text{Mg}$$

$$(4) {}^{23}_{11}\text{Na}$$

Sol. (2)

On balance the equation we find that X is ${}^{22}_{10}\text{Ne}$

SECTION - B

- 36.** A series LCR circuit with inductance 10H, capacitance 10 μ F, resistance 50 Ω is connected to an ac source of voltage $V = 200 \sin(100t)$ volt. If the resonant frequency of the LCR circuit is v_0 and the frequency of the ac source is v then :

(1) $v_0 = v = \frac{50}{\pi}$ Hz

(2) $v_0 = \frac{50}{\pi}$ Hz, $v = 50$ Hz

(3) $v = 100$ Hz, $v_0 = \frac{100}{\pi}$ Hz

(4) $v_0 = v = 5$ Hz

Sol. (1)

$$\text{Resonant frequency } (v_0) = \frac{1}{2\pi\sqrt{LC}}$$

Since, $L = 10$ H

$C = 10\mu\text{F} = 10^{-5}\text{F}$

$$v_0 = \frac{1}{2\pi\sqrt{10 \times 10^{-5}}} = \frac{1}{2\pi \times 10^{-2}}$$

$$\frac{100}{2\pi} = \frac{50}{\pi} \text{ Hz}$$

On comparing with

$v = v_0 \sin \omega t$

$\omega = 100$

$2\pi\omega = 100$

$$\omega = \frac{100}{2\pi} = \frac{50}{\pi} \text{ Hz}$$

Hence, option (1) correct.

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

List-I

- (a) Gravitational constant (G)
 - (b) Gravitaional potential energy
 - (c) Gravitational potential
 - (d) Gravitational intensity
- (1) (a) - (ii), (b) - (iv), (c) - (i), (d) - (iii)
 - (2) (a) - (ii), (b) - (iv), (c) - (iii), (d) - (i)
 - (3) (a) - (iv), (b) - (ii), (c) - (i), (d) - (iii)
 - (4) (a) - (ii), (b) - (i), (c) - (iv), (d) - (iii)

List-II

- (i) $[L^2T^{-2}]$
- (ii) $[M^{-1}L^3T^{-2}]$
- (iii) $[LT^{-2}]$
- (iv) $[ML^2T^{-2}]$

Sol. (1)

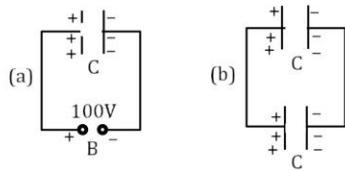
$$(a) G \rightarrow \frac{Fr^2}{m^2} = \frac{[MLT^{-2}][L^2]}{[M^2]} = [M^{-1}L^3T^{-2}]$$

(b) Gravitational potential energy \Rightarrow Dimension of energy ML^2T^{-2}

$$(c) \text{Gravitational potential} = \frac{w}{m} = \frac{ML^2T^{-2}}{M} = [L^2T^{-2}]$$

$$(d) \text{Gravitational intensity} = \frac{f}{m} = \frac{MLT^{-2}}{M} = [LT^{-2}]$$

38. A capacitor of capacitance $C = 900\text{pF}$ is charged fully by 100V battery B as shown in figure (a). Then it is disconnected from the battery and connected to another uncharged capacitor of capacitance $C = 900\text{pF}$ as shown in figure (b). The electrostatic energy stored by the system (b) is :



- (1) $3.25 \times 10^{-6}\text{ J}$
- (2) $2.25 \times 10^{-6}\text{ J}$
- (3) $1.5 \times 10^{-6}\text{ J}$
- (4) $4.5 \times 10^{-6}\text{ J}$

Sol. (2)

$$\begin{aligned} q &= CV \\ &= (900 \text{ pF})(100) \\ &= (900 \times 10^{-12})(100) \\ &= 9 \times 10^{-8}\text{C} \end{aligned}$$

Since charge remain constant for given case.

Energy store in system b is

$$\begin{aligned} C_{eq} &= 2C = 1800 \times 10^{-12}\text{F} \\ &= 18 \times 10^{-10}\text{F} \\ \therefore E_b &= \frac{(9 \times 10^{-8})^2}{2 \times 18 \times 10^{-10}} = \frac{81 \times 10^{-16}}{36 \times 10^{-10}} \\ &= 2.25 \times 10^{-6}\text{J} \end{aligned}$$

39. Two transparent media A and B are separated by a plane boundary. The speed of light in those media are $1.5 \times 10^8 \text{ m/s}$ and $2.0 \times 10^8 \text{ m/s}$, respectively. The critical angle for a ray of light for these two media is :
- (1) $\sin^{-1}(0.750)$
 - (2) $\tan^{-1}(0.500)$
 - (3) $\tan^{-1}(0.750)$
 - (4) $\sin^{-1}(0.500)$

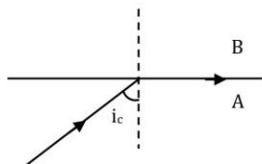
Sol. (1)

$$\text{Since, } \mu = \frac{C}{V}$$

$$\therefore \mu_A = \frac{C}{V_A}$$

$$\text{and } \mu_B = \frac{C}{V_B}$$

on observing the speed we can say media A is denser.



$$\therefore \mu_A \sin i_c = \mu_B \sin 90^\circ = \mu_B$$

$$\sin i_c = \frac{\mu_B}{\mu_A} = \frac{C/V_B}{C/V_A} = \frac{V_A}{V_B}$$

$$= \frac{1.5 \times 10^8}{2 \times 10^8} = 0.750$$

$$\therefore i_c = \sin^{-1}(0.750)$$

- 40.** The volume occupied by the molecules contained in 4.5 kg water at STP if the intermolecular forces vanish away is :

(1) $5.6 \times 10^3 \text{ m}^3$

(2) $5.6 \times 10^{-3} \text{ m}^3$

(3) 5.6 m^3

(4) $5.6 \times 10^6 \text{ m}^3$

Sol. (3)

$$\mu = \frac{\text{mass of water}}{\text{molecular weight}} = \frac{4.5}{18 \times 10^{-3}} = 250$$

$$T = 273, P = 10^5 \text{ N/m}^2$$

$$PV = \mu RT$$

$$V = \frac{\mu RT}{P}$$

$$= \frac{250 \times 8.3 \times 273}{10^5}$$

$$= 5.6 \text{ m}^3$$

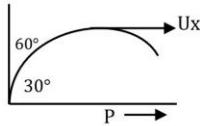
- 41.** A ball is projected with a velocity, 10 ms^{-1} , at an angle of 60° with the vertical direction. Its speed at the highest point of its trajectory will be:

(1) $5\sqrt{3} \text{ ms}^{-1}$ (2) 5 ms^{-1} (3) 10 ms^{-1} (4) Zero

Sol.

(1)

At maxm height



$$\begin{aligned} 4x &= 4 \cos \theta \\ &= 10 \cos 30^\circ \\ &= 10 \times \frac{\sqrt{3}}{2} = 5\sqrt{3} \text{ m/s} \end{aligned}$$

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

Assertion (A):

The stretching of a spring is determined by the shear modulus of the material of the spring.

Reason (R):

A coil spring of copper has more tensile strength than a steel spring of same dimensions.

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 not the correct explanation of (A)
 (2) (A) is true but (R) is false
 (3) (A) is false but (R) is true
 (4) Both (A) and (R) are true and (R) is the correct explanation of (A)

Sol.

(2)

Because the stretching of coil simply change it's shape without any change in length of the wire used in coil.
 Due to which shean modulus of elasticity is involved.

$$Y_{\text{steel}} > Y_{\text{copper}}$$

- 43.** Two pendulums of length 121 cm and 100 cm start vibrating in phase. At some instant, the two are at their mean position in the same phase. The minimum number of vibrations of the shorter pendulum after which the two are again in phase at the mean position is:

(1) 9 (2) 10 (3) 8 (4) 11

Sol.

(4)

$$T = 2\pi \sqrt{\frac{\ell}{g}}$$

$$\frac{T_1}{T_2} = \sqrt{\frac{121}{100}}$$

$$\frac{T_1}{T_2} = \frac{11}{10}$$

$$11 T_2 = 10 T_1$$

11 oscn of smaller is equal to 10 oscn of T_1

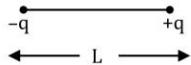
44. A big circular coil of 1000 turns and average radius 10 m is rotating about its horizontal diameter at 2 rad s^{-1} . If the vertical component of earth's magnetic field at that place is $2 \times 10^{-5} \text{ T}$ and electrical resistance of the coil is 12.56Ω , then the maximum induced current in the coil will be:

(1) 1.5 A (2) 1 A (3) 2 A (4) 0.25 A

Sol. (2)

$$\begin{aligned}
 i &= \frac{e_{\max}}{R} = \frac{NBAW}{R} \\
 &= \frac{1000 \times 2 \times 10^{-5} \times \pi \times 10^2 \times 2}{12.56} \\
 &= \frac{12.56}{12.56} = 1 \text{ A}
 \end{aligned}$$

45. Two point charges $-q$ and $+q$ are placed at a distance of L , as shown in the figure.



The magnitude of electric field intensity at a distance R ($R \gg L$) varies as:

(1) $\frac{1}{R^3}$ (2) $\frac{1}{R^4}$ (3) $\frac{1}{R^6}$ (4) $\frac{1}{R^2}$

Sol. (1)

$$E = \frac{2kP}{B^3} = E \propto \frac{1}{B^3}$$

46. A nucleus of mass number 189 splits into two nuclei having mass number 125 and 64. The ratio of radius of two daughter nuclei respectively is :

(1) 4 : 5

(2) 5 : 4

(3) 25 : 16

(4) 1 : 1

Sol. (2)

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

$$R \propto A^{1/3}$$

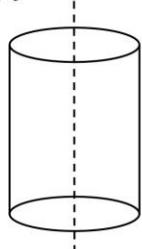
$$\frac{R_1}{R_2} = \left[\frac{A_1}{A_2} \right]^{1/3}$$

$$\frac{R_1}{R_2} = \left[\frac{125}{64} \right]^{1/3}$$

$$\frac{R_1}{R_2} = \frac{5}{4}$$

- 47.** From Ampere's circutal law for a long straight wire of circular cross-section carrying a steady current, the variation of magnetic field in the inside and outside region of the wire is :
- a linearly increasing function of distance upto the boundary of the wire and then linearly decreasing for the outside region.
 - a linearly increasing function of distance r upto the boundary of the wire and then decreasing one with $1/r$ dependence for the outside region.
 - a linearly decreasing function of distance upto the boundary of the wire and then a linearly increasing one for the outside region.
 - uniform and remains constant for both the regions.

Sol. (2)

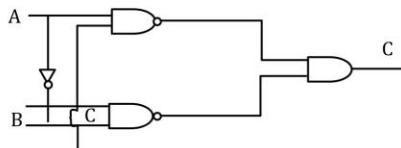


$$B_{in} = \frac{\mu_0 I r}{2\pi R^2}$$

$$B_s = \frac{\mu_0 I}{2\pi R}$$

$$B_o = \frac{\mu_0 I}{2\pi r}$$

48.



The truth table for the given logic circuit is :

A	B	C
0	0	1
0	1	0
1	0	0
1	1	1

(1) 0 1 0

A	B	C
0	0	1
0	1	0
1	0	1
1	1	0

(2) 0 1 0

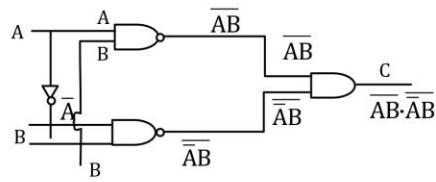
A	B	C
0	1	1
1	0	0
1	1	1

(3) 0 1 1

A	B	C
0	0	0
0	1	1
1	0	1
1	1	0

(4) 0 1 1

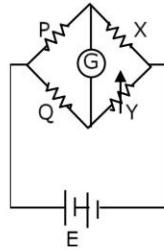
Sol. (2)



$$\begin{aligned}
 C &= \overline{AB} \cdot \overline{\bar{A}B} \\
 &= (\bar{A} + \bar{B})(A + \bar{B}) \\
 &= A\bar{A} + A\bar{B} + A\bar{B} + \bar{B}\bar{B} \\
 &= \bar{A}\bar{B} + A\bar{B} + \bar{B} \\
 &= \bar{A}\bar{B} + \bar{B}(A + 1) \\
 C &= \bar{B}(\bar{A} + 1)
 \end{aligned}$$

A	B	\bar{A}	\bar{B}
0	0	1	1
0	1	1	0
1	0	0	1
1	1	0	0

- 49.** A wheatstone bridge is used to determine the value of unknown resistance X by adjusting the variable resistance Y as shown in the figure. For the most precise measurement of X, the resistance P and Q :



- (1) should be approximately equal and are small
- (2) should be very large and unequal
- (3) do not play any significant role
- (4) should be approximately equal to 2x

Sol. (1)

Resistance of P & Q should be approx.. equal as it decreases error in experiment.

- 50.** The area of a rectangular field (in m^2) of length 55.3m and breadth 25m after rounding off the value for correct significant digits is :
- (1) 1382
 - (2) 1382.5
 - (3) 14×10^2
 - (4) 138×10^1

Sol. **(3)**

$$\begin{aligned}A &= l \times B \\&= 55.3 \times 25 \\&= 1382.5 \approx 14 \times 10^2\end{aligned}$$

CHEMISTRY
SECTION - A

51. Identify the incorrect statement from the following.
- All the five 4d orbitals have shapes similar to the respective 3d orbitals
 - In an atom, all the five 3d orbitals are equal in energy free state.
 - The shapes of d_{xy} , d_{yz} , and d_{zx} orbitals are similar to each other; and $d_{x^2-y^2}$ and d_{z^2} are similar to each other.
 - All the five 5d orbitals are different in size when compared to the respective 4d orbitals

Sol. (3)

$d_{x^2-y^2}$ is double dumbbell while d_{z^2} has a butterfly shape.

52. Given below are two statements :

Statement I :

The acidic strength of monosubstituted nitrophenol is higher than phenol because of electron withdrawing nitro group.

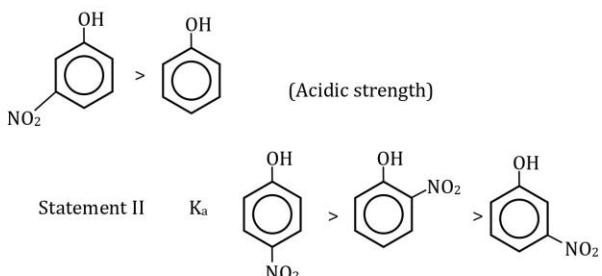
Statement II :

o-nitrophenol, *m*-nitrophenol and *p*-nitrophenol will have same acidic strength as they have one nitro group attached to the phenolic ring.

In either of the above statement, choose the most appropriate answer from the options given below :

- Both Statement I and Statement II are incorrect.
- Statement I is correct but Statement II is incorrect.
- Statement I is incorrect but Statement II is correct.
- Both Statement I and Statement II are correct.

Sol. (2)



I is correct II is incorrect.

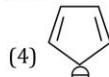
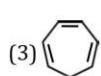
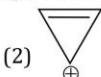
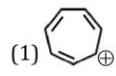
53. The incorrect statement regarding chirality is :

- (1) The product obtained by S_N^2 reaction of haloalkane having chirality at the reactive site shows inversion of configuration.
- (2) Enantiomers are superimposable mirror images on each other.
- (3) A racemic mixture shows zero optical rotation.
- (4) S_N^2 reaction yields 1 : 1 mixture of both enantiomers.

Sol. (2)

Enantiomers are non-superimposable mirror images on each other.

54. Which compound amongst the following is not an aromatic compound ?



Sol. (3)

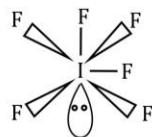
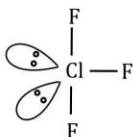
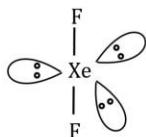


- compound is cyclic
 - compound is not planar
- so it is not aromatic

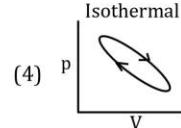
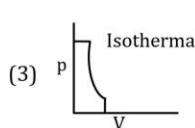
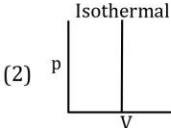
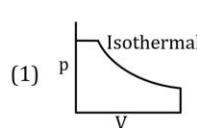
55. Amongst the following which one will have maximum 'lone pair-lone pair' electron repulsions.

- (1) IF_5
- (2) SF_4
- (3) XeF_2
- (4) ClF_3

Sol. (3)



56. Which of the following p-V curve represents maximum work done ?



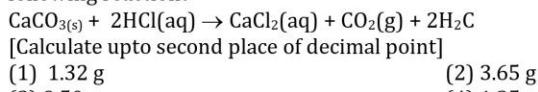
Sol. (1)

Max area under the curve max. work done

57. The IUPAC name of the complex $[\text{Ag}(\text{H}_2\text{O})_2][\text{Ag}(\text{CN})_2]$ is :
(1) diaquasilver (II) dicyanidoargentate (II)
(2) dicyanidosilver (I) and diaquaargentate (I)
(3) diaquasilver (I) dicyanidoargentate(I)
(4) dicyanidosilver(II) diaquaargentate(II)

Sol. (3)
diaquasilver (I) dicyanidoargentate(I)

58. What mass of 95% pure CaCO_3 will be required neutralize 50mL of 0.5 M HCl solution according the following reaction?



- (1) 1.32 g (2) 3.65 g
(3) 9.50 g (4) 1.25 g

Sol. (1)
 $\text{CaCO}_{3(s)} + 2\text{HCl(aq)} \rightarrow \text{CaCl}_2\text{(aq)} + \text{CO}_2\text{(g)} + 2\text{H}_2\text{O}$
 $50 \times \frac{1}{2}$
 $= 25 \text{ m mol}$
Moles of $\text{CaCO}_3 = 12.5 \text{ m mol}$
 $\text{Mass of CaCO}_3 = \frac{12.5 \times 100}{1000} \times \frac{100}{95}$
 $= 1.32 \text{ g}$

59. Match List-I with List-II.

List-I (Drug class)	List-II (Drug molecule)
(a) Antacids	(i) Salvarsan
(b) Antihistamines	(ii) Morphine
(c) Analgesics	(iii) Cimetidine
(d) Antimicrobials	(iv) Seldane

Choose the correct answer from the options give below :

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

Sol. (1)
(a) Antacids \rightarrow (iii) cematinidine
(b) Antihistamine \rightarrow (iv) Seldane
(c) Analgesics \rightarrow (ii) Morphine
(d) Antimicrobials \rightarrow (i) Salvarsan

60. Match List-I with List-II.

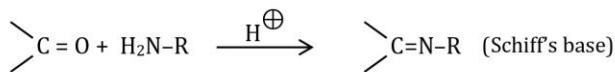
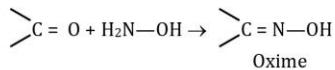
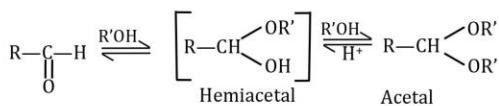
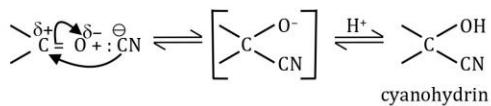
List-I (Products formed)	List-II (Reaction of carbonyl Compound with)
(a) Cynohydrin	(i) NH_2OH
(b) Acetal	(ii) RNH_2
(c) Schiff's base	(iii) alcohol
(d) Oxime	(iv) HCN

Choose the correct answer from the options give below :

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

Sol. (3)

List-I	List-II
(a) Cynohydrin	(iv) HCN
(b) Acetal	(iii) alcohol
(c) Schiff's base	(ii) RNH_2
(d) Oxime	(i) NH_2OH



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

Assertion (A) : ICl is more reactive than I₂.

Reason (R) : I-Cl bond is weaker than I-I bond.

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

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

Sol. (4)

[NCERT (XII) Page No. 207 Vol.-I]

ICl is more reactive than I₂ due to its polar bond character.

- 62.** Which one is not correct mathematical equation for Dalton's Law of partial pressure ? Here p=total pressure of gaseous mixture.

$$(1) p = n_1 \frac{RT}{V} + n_2 \frac{RT}{V} + n_3 \frac{RT}{V}$$

$$(2) p_i = x_i p, \text{ where } p_i = \text{partial pressure of } i^{\text{th}} \text{ gas}$$

$x_i = \text{mole fraction of } i^{\text{th}} \text{ gas in gaseous mixture}$

$$(3) p_i = x_i p_1^{\circ}, \text{ where } x_i = \text{mole fraction of } i^{\text{th}} \text{ gas in gaseous mixture}$$

$p_1^{\circ} = \text{mole fraction of } i^{\text{th}} \text{ gas in gaseous mixture}$

$$(4) p = p_1 + p_2 + p_3$$

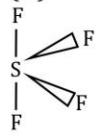
Sol. (3)

$p_i = x_i p_1^{\circ}$, this is not dalton's law

- 63.** Which amongst the following is incorrect statement ?

- (1) C₂ molecule has four electron in its two degenerate π molecular orbitals.
- (2) H₂⁺ ion has one electron.
- (3) O₂⁺ ion is diamagnetic.
- (4) The bond orders of O₂⁺, O₂, O₂⁻ and O₂²⁻ are 2.5, 2, 1.5 and 1, respectively.

Sol. (3)



Max lp at 120° in xef₂

(1) O₂⁺ 1s e⁻ add e⁻ = para

(2) O₂⁺ O₂ O₂⁻ O₂²⁻

30 2.5 1.5 1

(3) C₂ σ 1s² σ^* 1s² σ 2s² σ^* 2s² π 2px² = π 2py²

Total = 12

(4) H₂⁺ 1e⁻

Sol. (1)

$$1 = \frac{0.5}{W}$$

$$W = 0.5 \text{ kg}$$

$$W = 500 \text{ gm}$$

- 65.** Given below are two statement :

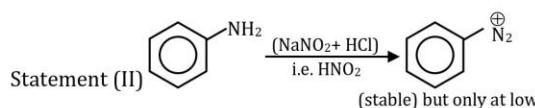
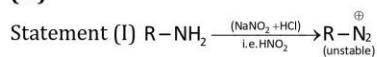
Statement I :

Primary aliphatic amines react with HNO_2 to give unstable diazonium salts.

Statement II : Primary aromatic amines react with HNO_2 to form diazonium salts which are stable even above 300 K. In the light of the above statement, choose the most appropriate answer from the options given below :

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

Sol. (2)



Temperature i.e. 0–5°C (273K – 276 K) so at above 300K it will be unstable.

Statement I is correct but II incorrect.

- 66.** Given below are two statements :

Statement I :

The boiling points of the following hydrides of group 16 elements increases in the order – $\text{H}_2\text{O} < \text{H}_2\text{S} < \text{H}_2\text{Se} < \text{H}_2\text{Te}$

Statement II:

The boiling points of these hydrides increase with increase in molar mass.

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

- In the light of the above statements, choose the most appropriate option.

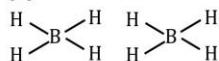
 - (1) Both Statement I and Statement II are incorrect.
 - (2) Statement I is correct but Statement II is incorrect.
 - (3) Statement I is incorrect but Statement II is correct.
 - (4) Both Statement I and Statement II are correct.

Sol. (1)

Order of BP for VIA $H_2S < H_2Se < H_2Te < H_2$

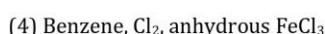
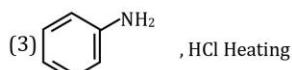
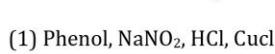
- 67.** Which of the following statement is not correct about diborane?
 (1) The four terminal B-H bonds are two centre two electron bonds.
 (2) The four terminal Hydrogen atoms and the two Boron atoms lie in one plane.
 (3) Both the Boron atoms are sp^2 hybridised.
 (4) There are two 3-centre-2-electron bonds.

Sol. (3)

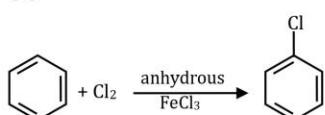


Both Boron atoms are sp^3 hybrid.

- 68.** Which of the following is suitable to synthesize chlorobenzene ?



Sol. (4)



- 69.** Given below are stamens :

Statements I:

In the coagulation of negative sol, the flocculating power of the three given ions is in the order :

$\text{Al}^{3+} > \text{Ba}^{2+} > \text{Na}^+$

Statements II :

In the coagulations of a positive sol, the flocculating power of the three given salts is in the order-

$\text{NaCl} > \text{Na}_2\text{SO}_4 > \text{Na}_3\text{PO}_4$

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 incorrect.
- (2) Statement I is correct but Statement II is incorrect.
- (3) Statement I is incorrect but Statement II is correct.
- (4) Both Statement I and Statement II are correct.

Sol. (2)

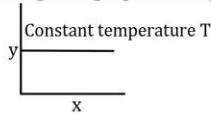
Order of coagulation power

$\text{Al}^{3+} > \text{Ba}^{2+} > \text{Na}^+$

Order of coagulation power

For +ve sol $\text{PO}_4^{3-} > \text{SO}_4^{2-} > \text{Cl}^-$

70. The given graph is a representation of kinetics of a reaction.

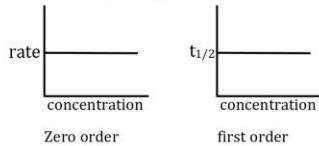


The y and x axes for zero and first order reactions, respectively are :

- (1) zero order ($y = \text{concentration}$ and $x = \text{time}$), first order ($y = \text{rate constant}$ and $x = \text{concentration}$)
- (2) zero order ($y = \text{rate}$ and $x = \text{concentration}$), first order ($y = t_{1/2}$ and $x = \text{concentration}$)
- (3) zero order ($y = \text{rate}$ and $x = \text{concentration}$), first order ($y = \text{rate}$ and $x = t_{1/2}$)
- (4) zero order ($y = \text{concentration}$ and $x = \text{time}$), first order ($y = t_{1/2}$ and $x = \text{concentration}$)

Sol. (2)

- zero order ($y = \text{rate}$ and $x = \text{concentration}$)
first order ($y = t_{1/2}$ and $x = \text{concentration}$)



71. Gadolinium has a low value of third ionization enthalpy because of :

- (1) high exchange enthalpy
- (2) high electronegativity
- (3) high basic character
- (4) small size

Sol. (1)

$\text{Gd}_{64} 4f^7 5d^1 6s^2$
high exchange enthalpy

72. Given below are two statements :

Statements I:

The boiling points of aldehydes and ketones are higher than hydrocarbons of comparable molecular masses because of weak molecular association in aldehydes and ketones due to dipole-dipole interactions.

Statements II :

The boiling points of aldehydes and ketones are lower than the alcohols of similar molecular masses due to the absence of H-bonding.

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 incorrect.
- (2) Statement I is correct but Statement II is incorrect.
- (3) Statement I is incorrect but Statement II is correct.
- (4) Both Statement I and Statement II are correct.

Sol. (4)

[NCERT (XII) Page No. 365 Vol-II]

Sol. (4)

119 Ununennium

74. The pH of the solution containing 50 mL each of 0.10 M sodium acetate and 0.01 M acetic acid is :
[Given : pK_a of CH_3COOH = 4.57]
(1) 3.57 (2) 4.57 (3) 2.57 (4) 5.57

Sol. (4)

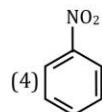
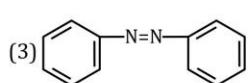
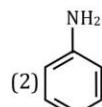
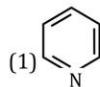
$$pH = 4.57 + \log \frac{50 \times 0.1}{50 \times 0.01}$$

$$pH = 4.57 + \log 10$$

$$\text{pH} = 4.57 + 1$$

pH= 5.57

75. The Kjeldahl's method for the estimation of nitrogen can be used to estimate the amount of nitrogen in which one of the following compounds?



Sol. (2)

[NCERT (XII) Page No. 366 Vol.-I]



In Kjeldahl's method is not applicable to N present in Nitro and Azo group and N present in the ring like pyridine.

76. Given below are two statements : one is labelled as :

Assertion (A) and the other is labelled as **Reason (R)**.

Assertion (A) :

In a particular point defect, an ionic solid is electrically neutral, even if few of its cations are missing from its unit cells.

Reason (R) :

In an ionic solid, Frenkel defect arises due to dislocation of cation from its lattice site to interstitial site, maintaining overall electrical neutrality.

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

(1) Both (A) and (R) are correct but (R) is not the correct explanation of (A).

(2) (A) is correct but (R) is not correct.

(3) (A) is not correct but (R) is correct.

(4) Both (A) and (R) are correct but (R) is the correct explanation of (A).

Sol. (1)

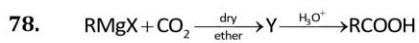
Both (A) and (R) are correct but (R) is not the correct explanation of (A)

77. Match List-I with List-II.

List-I	List-II
(Hydrides)	(Nature)
(a) MgH_2	(i) Electron precise
(b) GeH_4	(ii) Electron deficient
(c) B_2H_6	(iii) Electron rich
(d) HF	(iv) Ionic
(1) (a)-(iii), (b)-(i), (c)-(ii), d-(iv)	
(2) (a)-(i), (b)-(ii), (c)-(iv), d-(iii)	
(3) (a)-(ii), (b)-(iii), (c)-(iv), d-(i)	
(4) (a)-(iv), (b)-(i), (c)-(ii), d-(iii)	

Sol. (4)

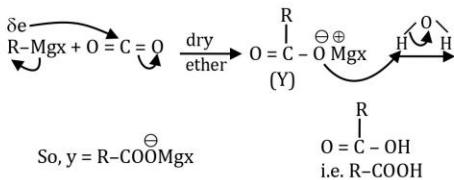
(a) MgH_2	→	(iv) Ionic
(b) GeH_4	→	(i) Electron precise
(c) B_2H_6	→	(ii) Electron deficient
(d) HF	→	(iii) Electron rich



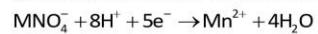
What is Y in the above reaction :

- (1) $\text{R}_3\text{CO}^- \text{Mg}^\cdot \text{X}$
 (2) $\text{RCOO}^- \text{X}^\cdot$
 (3) $(\text{RCOO})_2\text{Mg}$
 (4) $\text{RCOO}^- \text{Mg}^\cdot \text{X}$

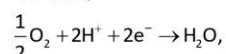
Sol. (4)



79. Given below are half cell reaction:



$$E_{\text{Mn}^{2+}/\text{MnO}_4^-}^\circ = -1.510\text{V}$$

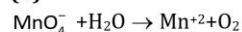


$$E_{\text{O}_2/\text{H}_2\text{O}}^\circ = +1.223\text{V}$$

Will the permanganate ion, MnO_4^- liberate O_2 from water in the presence of an acid?

- (1) No, because $E_{\text{cell}}^\circ = -0.287\text{ V}$
 (2) Yes, because $E_{\text{cell}}^\circ = +2.733\text{ V}$
 (3) No, because $E_{\text{cell}}^\circ = -2.733\text{ V}$
 (4) Yes, because $E_{\text{cell}}^\circ = +0.287\text{ V}$

Sol. (4)



$$E_{\text{cell}}^\circ = 1.51 - 1.223$$

$$E_{\text{cell}}^\circ = +0.287$$

Yes MnO_4^- liberate O_2 from water in the presence of an acid

80. Which statement regarding polymers is not correct?

- (1) Fibers possess high tensile strength.
 (2) Thermoplastic polymers are capable of repeatedly softening and hardening on heating and cooling respectively.
 (3) Thermosetting polymers are reusable.
 (4) Elastomers have polymer chains held together by weak intermolecular forces.

Sol. (3)

Thermosetting polymers are not reusable.

- 81.** At 298 K, the standard electrode potential of Cu^{2+}/Cu , Zn^{2+}/Zn , Fe^{2+}/Fe and Ag^+/Ag are 0.34 V, -0.76 V, -0.44 V and 0.80 V, respectively.

On the basis of standard electrode potential, predict which of the following reaction can not occur?

- (1) $\text{CuSO}_4(\text{aq}) + \text{Fe}(\text{s}) \rightarrow \text{FeSO}_4(\text{aq}) + \text{Cu}(\text{s})$
- (2) $\text{FeSO}_4(\text{aq}) + \text{Zn}(\text{s}) \rightarrow \text{ZnSO}_4(\text{aq}) + \text{Fe}(\text{s})$
- (3) $2\text{CuSO}_4(\text{aq}) + 2\text{Ag}(\text{s}) \rightarrow 2\text{Cu}(\text{s}) + \text{Ag}_2\text{SO}_4(\text{aq})$
- (4) $\text{CuSO}_4(\text{aq}) + \text{Zn}(\text{s}) \rightarrow \text{ZnSO}_4(\text{aq}) + \text{Cu}(\text{s})$

Sol. (3)

Order of reactivity

$\text{Zn} > \text{Fe} > \text{Cu} > \text{Ag}$ (Reactivity)

- 82.** The incorrect statement from the following :

- (1) Like chemical catalysis enzymes reduce the activation energy of bio processes.
- (2) Enzymes are polysaccharides.
- (3) Enzymes are very specific for a particular reaction and substrate.
- (4) Enzymes are biocatalysts.

Sol. (2)

All Enzymes are protein.

- 83.** Identify the incorrect statement from the following :

- (1) The oxidation number of in KO_2 is +4.
- (2) Ionisation enthalpy of alkali metals decreases from top to bottom in the group.
- (3) Lithium is the strongest reducing agent among the alkali metals.
- (4) Alkali metals react with water to form their hydroxides. s

Sol. (1)

Oxidation states of K in KO_2 is +1 as it is a superoxide.

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

List-I	List-II
--------	---------

- | | |
|--|--|
| (a) Li | (i) absorbent for carbon dioxide |
| (b) Na | (ii) electrochemical cells |
| (c) KOH | (iii) coolant in fast breeder reactors |
| (d) Cs | (iv) photoelectric cell |
| (1) (a)-(iii), (b)-(iv), (c)-(ii), d-(i) | |
| (2) (a)-(i), (b)-(iii), (c)-(iv), d-(ii) | |
| (3) (a)-(ii), (b)-(iii), (c)-(i), d-(iv) | |
| (4) (a)-(iv), (b)-(i), (c)-(iii), d-(ii) | |

Sol. (3)

- | | |
|---------|--|
| (a) Li | (ii) electrochemical cells |
| (b) Na | (iii) coolant in fast breeder reactors |
| (c) KOH | (i) absorbent for carbon dioxide |
| (d) Cs | (iv) photoelectric cell |

85. Choose the correct statement :

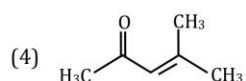
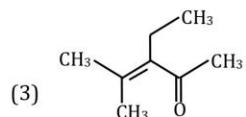
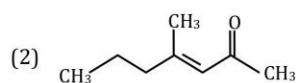
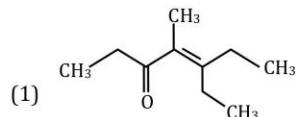
- (1) Diamond is covalent and graphite is ionic.
- (2) Diamond is sp^3 hybridised and graphite is sp^2 hybridized.
- (3) Both diamond and graphite are used as dry lubricants.
- (4) Diamond and graphite have two dimensional network.

Sol. **(2)**

Diamond- sp^3 Graphite- sp^2

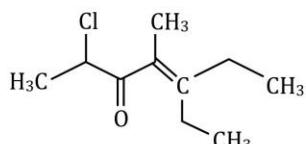
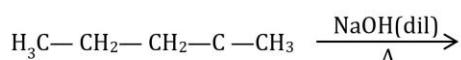
Section-B

86. Which one of the following is not formed when acetone reacts with 2-pentanone in the presence of dilute NaOH followed by heating ?



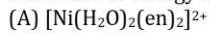
Sol. **(1)**

Its aldol condensation reaction. So products not possible is

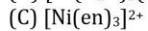


This compound will be formed if pentan-3-one is involved in this reaction so, it will not be formed as product since in the reaction organic substrate is not pentan-3-one, here organic substrate are pentan-2-one and acetone.

87. The order of energy absorbed which is responsible for the color of complexes.



(B) $[\text{Ni}(\text{H}_2\text{O})_4(\text{en})]^{2+}$ and



is :

(1) (C) > (B) > (A)

(2) (C) > (A) > (B)

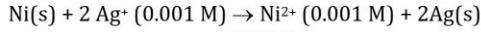
(3) (B) > (A) > (C)

(4) (A) > (B) > (C)

Sol. **(2)**

$v_{\text{abs}} \propto$ strength of ligands.

88. Find the emf of the cell in which the following reaction takes place at 298 K



$$(\text{Given that } E_{\text{cell}}^\circ = 10.5 \text{ V}, \frac{2.303RT}{F} = 0.059 \text{ at } 298 \text{ K})$$

(1) 1.385 V

(2) 0.9615 V

(3) 1.05 V

(4) 1.385 V

Sol. **(Bonus)**

$$E_{\text{cell}} = 10.5 - \frac{0.059}{2} \log \frac{10^{-3}}{10^{-6}}$$

$$= 10.5 - 0.0295 \times 3$$

$$= 10.5 - 0.088$$

$$= 10.41 \text{ V}$$

89. Match List-I with List-II.

List-I

(Ores)

(a) Haematite

List-II

(Composititon)



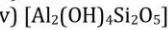
(b) Magnetite



(c) Calamine



(d) Kaolinite



(1) (a)-(iii), (b)-(i), (c)-(ii), d-(iv)

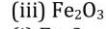
(2) (a)-(iii), (b)-(i), (c)-(iv), d-(ii)

(3) (a)-(i), (b)-(iii), (c)-(ii), d-(iv)

(4) (a)-(i), (b)-(ii), (c)-(iii), d-(iv)

Sol. **(1)**

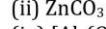
(a) Haematite



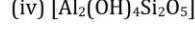
(b) Magnetite



(c) Calamine



(d) Kaolinite



90. In the neutral or faintly alkaline medium, KMnO_4 oxidises iodide into iodate. The change in oxidation state of manganese in this reaction is form :

(1) +6 to +4

(2) +7 to +3

(3) +6 to +5

(4) +7 to +4

Sol. **(4)**

Weak alkaline medium



- 91.** Given below are two statements :

Statements I:

In Lucas test, primary, secondary and tertiary alcohols distinguished on the basis of their reactivity with conc. $\text{HCl} + \text{ZnCl}_2$, known as Lucas Reagent.

Statements II :

Primary alcohols are most reactive and immediately produce turbidity at room temperature on reaction with Lucas Reagent.

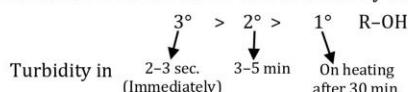
In the light of the above statements, choose the most appropriate answer from the options given below.

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

Sol. (2)

Statement I : is correct Lucas reagent is used to differentiate primary, secondary & Tertiary alcohol.

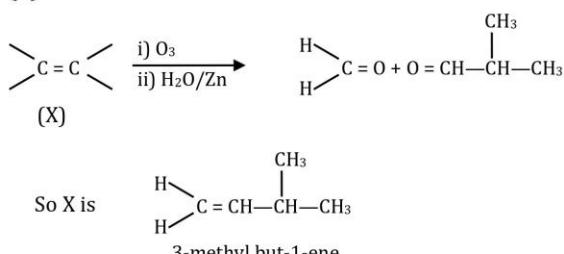
Statement II : is incorrect since reactivity order of alcohol towards Lucas reagent ($\text{HCl} + \text{ZnCl}_2$) is :



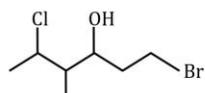
- 92.** Compound X on reaction with O_3 followed by $\text{Zn}/\text{H}_2\text{O}$ gives formaldehyde and 2-methyl propanal as products. The compound X is :

- (1) 2-Methylbut-1-ene
- (2) 2-Methylbut-2-ene
- (3) Pent-2-ene
- (4) 3-Methylbut-1-ene

Sol. (4)

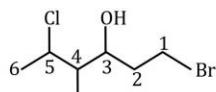


- 93.** The correct IUPAC name of the following compound is :



- (1) 6-bromo-2-chloro-4-methylhexan-4-ol
- (2) 1-bromo-4-methyl-5-chlorohexan-3-ol
- (3) 6-bromo-4-methyl-2-chlorohexan-4-ol
- (4) 1-bromo-5-chloro-4-methylhexan-3-ol

Sol. (4)



- 94.** A 10.0 L flask contains 64 g of oxygen at 27°C. (Assume O₂ gas is behaving ideally). The pressure inside the flask in bar is :

(Given : R = 0.0831 L bar K⁻¹ mol⁻¹)

(1) 498.6

(2) 49.8

(3) 4.9

(4) 2.5

Sol. (3)

$$PV=nRT$$

$$P \times 10 = \frac{64}{32} \times 0.083 \times 300$$

$$P = 4.98$$

- 95.** The pollution due to oxides of Sulphur gets enhanced due to the presence of :

(a) particulate matter

(b) ozone

(c) hydrocarbons

(d) hydrogen peroxide

Choose the most appropriate answer from the options given below :

(1) (a), (b), (d) only

(2) (b), (c), (d) only

(3) (a), (c), (d) only

(4) (a), (d) only

Sol. (1)

[INCERT (XI) Page No. 407] Environmental Chemistry

- 96.** For a first order reaction A → Product, initial concentration of A is 0.1 M, which becomes 0.001 M after 5 minutes. Rate constant for the reaction in min⁻¹ is :

(1) 0.9212

(2) 0.4606

(3) 0.2303

(4) 1.3818

Sol. (1)

$$K = \frac{2.303}{5} \log \frac{0.1}{0.001}$$

$$= \frac{2.303}{5} \times 2$$

$$= \frac{4.606}{5}$$

$$= 0.9212$$

97. Copper crystallises in fcc unit cell with cell edge length of 3.608×10^{-8} cm. The density of copper is 8.92 g cm^{-3} . Calculate the atomic mass of copper.

(1) 31.55 u (2) 60 u (3) 65 u (4) 63.1 u

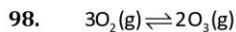
Sol. **(4)**

$$8.92 = \frac{4 \times M}{6 \times 10^{23} \times (3.608 \times 10^{-8})^3}$$

$$M = \frac{8.92 \times 6 \times 10^{23} \times (3.608)^3 \times 10^{-24}}{4}$$

$$= 62.84$$

$$\approx 63 \text{ u}$$



For the above reaction at 298 K, K_c is found to be 3.0×10^{-59} . If the concentration of O_2 at equilibrium is 0.040 M then concentration of O_3 in M is :

(1) 1.9×10^{-63} (2) 2.4×10^{31}
 (3) 1.2×10^{21} (4) 4.38×10^{-32}

Sol. **(4)**

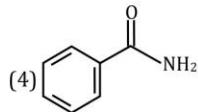
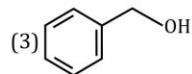
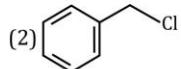
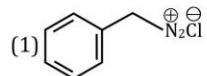
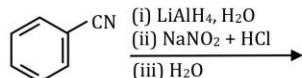
$$3 \times 10^{-59} = \frac{[\text{O}_3]^2}{[0.04]^3}$$

$$3 \times 10^{-59} \times (0.04)^3 = [\text{O}_3]^2$$

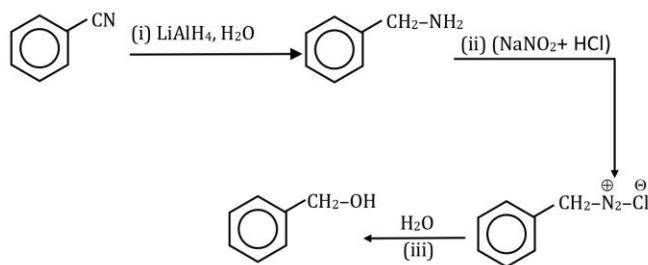
$$[\text{O}_3]^2 = 1920 \times 10^{-66}$$

$$[\text{O}_3] = 4.38 \times 10^{-32}$$

99. The product formed from the following reaction sequence is :



Sol. (3)



100. If radius of second Bohr orbit of the He^+ ion is 105.8 pm, what is the radius of third Bohr orbit of Li^{+2} ion ?

- (1) 15.87 pm (2) 1.587 pm (3) 158.7 Å (4) 158.7 pm

Sol. (4)

$$\frac{r_2}{r_3} = \frac{n_2^2}{n_3^2} \times \frac{Z_{\text{Li}^{+2}}}{Z_{\text{He}^+}}$$

$$\frac{105.8}{r_3} = \frac{4}{9} \times \frac{3}{2}$$

$$r_3 = 105.8 \times 1.5$$

$$r_3 = 158.7 \text{ pm}$$

BOTANY

Section – A

101. Which of the following is not a method of ex situ conservation ?

- (1) National parks
- (2) Micropropagation
- (3) Cryopreservation
- (4) In vitro fertilization

Sol. (1)

NCERT 12th Page No. 267

102. Given below are two statements :

Statement I :

The primary CO₂ acceptor in C₄ plants is phosphoenolpyruvate and is found in the mesophyll cells.

Statement II :

Mesophyll cells of C₄ plants lack RuBisCo enzyme. In the light of the above statements, chose the correct answer from the options given below :

- (1) Both Statement I and Statement II are incorrect
- (2) Statement I is correct but Statement II is incorrect
- (3) Statement I is incorrect but Statement II is correct
- (4) Both Statement I and Statement II are correct

Sol. (4)

NCERT 11th Page No. 219

103. Read the following statements about vascular bundles :

- (a) In roots, xylem and phloem in a vascular bundle are arranged in an alternate manner along the different radii
- (b) Conjoint closed vascular bundles do not possess cambium
- (c) In open vascular bundles, cambium is present in between xylem and phloem
- (d) The vascular bundles of dicotyledonous stem possess endarch protoxylem
- (e) In monocotyledonous root, usually there are more than six xylem bundles present

Choose the correct answer from the options given below :

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

Sol. (Bonus)

NCERT 11th Page No. 90, 91 93

104. Given below are two statements :

Statement I :

Mendel studied seven pairs of contrasting traits in pea plants and proposed the Laws of Inheritance

Statement II :

Seven characters examined by Mendel in his experiment on pea plants were seed shape and colour, flower colour, pod shape and colour, flower position and stem height

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

- (1) Both Statement I and Statement II are incorrect
- (2) Statement I is correct but Statement II is incorrect
- (3) Statement I is incorrect but Statement II is correct
- (4) Both Statement I and Statement II are correct

Sol. (4)

NCERT 12th Page No. 70, 71

105. Which one of following statements cannot be connected to Predation ?

- (1) It might lead to extinction of a species
- (2) Both the interacting species are negatively impacted
- (3) It is necessitated by nature to maintain the ecological balance
- (4) It helps in maintaining species diversity in a community

Sol. (2)

NCERT 12th Page No. 233

106. DNA polymorphism forms the basis of :

- (1) DNA finger printing
- (2) Both genetic mapping and DNA finger printing
- (3) Translation
- (4) Genetic mapping

Sol. (2)

NCERT 12th Page No. 221

107. Given below are two statements :

Statement I :

Cleistogamous flowers are invariably autogamous

Statement II:

Cleistogamy is disadvantageous as there is no chance for cross pollination

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

- (1) Both statement I and Statement II are incorrect
- (2) Statement I is correct but statement II is incorrect
- (3) Statement I is incorrect but statement II is correct
- (4) Both statement I and statement II are correct

Sol. (4)

NCERT 12th Page No. 28

108. In old trees the greater part of secondary xylem is dark brown and resistant to insect attack due to :

- (a) Secretion of secondary metabolites and their deposition in the lumen of vessels.
- (b) Deposition of organic compounds like tannins and resins in the central layers of stem.
- (c) Deposition of suberin and aromatic substances in the outer layer of stem.
- (d) Deposition of tannins, gum, resin and aromatic substances in the peripheral layers of stem.
- (e) Presence of parenchyma cells, functionally active xylem elements and essential oils.

Choose the correct answer from the options given below :

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

Sol. (4)

NCERT 11th Page No. 96

109. What is the net gain of ATP when each molecule of glucose is converted to two molecules of pyruvic acid ?

- | | | | |
|---------|---------|-----------|----------|
| (1) Six | (2) Two | (3) Eight | (4) Four |
|---------|---------|-----------|----------|

Sol. (3)

NCERT 11th Page No. 229

110. Which one of the following never occurs during mitotic cell division ?

- (1) Movement of centrioles towards opposite poles
- (2) Pairing of homologous chromosomes
- (3) Coiling and condensation of the chromatids
- (4) Spindle fibres attach to kinetochores of chromosomes

Sol. (2)

NCERT 11th Page No. 164

111. Production of Cucumber has increased manifold in recent years. Application of which of the following phytohormones has resulted in this increased yield as the hormone is known to produce female flowers in the plants :

- (1) Gibberellin
- (2) Ethylene
- (3) Cytokinin
- (4) ABA

Sol. (2)

NCERT 11th Page No. 250

112. Match List-I with List-II.

List -I

- (a) Manganese
- (b) Magnesium
- (c) Boron
- (d) Iron

List - II

- (i) Activates the enzyme catalase
- (ii) Required for pollen germination
- (iii) Activates enzymes of respiration
- (iv) Functions in splitting of water during photosynthesis

Choose the correct answer from the options given below :

- (1) (a) – (iv), (b) – (iii), (c) – (ii), (d) – (i)
- (2) (a) – (iv), (b) – (i), (c) – (ii), (d) – (iii)
- (3) (a) – (iii), (b) – (i), (c) – (ii), (d) – (iv)
- (4) (a) – (iii), (b) – (iv), (c) – (i), (d) – (ii)

Sol. (1)

NCERT 11th Page No. 197, 198,

113. The flowers are Zygomorphic in :

- (a) Mustard
- (b) Gulmohar
- (c) Cassia
- (d) Datura
- (e) Chilly

Choose the correct answer from the options given below :

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

Sol. (1)

NCERT 11th Page No. 72

114. Which of the following is incorrectly matched ?

- | | |
|-------------------------|---------------------------------|
| (1) Ulothrix – Mannitol | (2) Porphyra – Floridian Starch |
| (3) Volvox – Starch | (4) Ectocarpus - Fucoxanthin |

Sol. (1)

NCERT 11th Page No. 32, 33

115. Given below are two statements :

Statements I :

Decomposition is a process in which the detritus is degraded into simpler substances by microbes.

Statement II :

Decomposition is faster if the detritus is rich in lignin and chitin

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

- (1) Both Statement I and Statement II are incorrect
- (2) Statement I is correct but Statement II is incorrect
- (3) Statement I is incorrect but Statement II correct
- (4) Both Statement I and Statement II are correct

Sol. (2)

NCERT 11th Page No. 243, 244

Sol. (2)

NCERT 11th Page No. 168

Sol. (3)

NCERT 11th Page No. 246

- 118.** Read the following statements and choose the set of correct statements :

 - (a) Euchromatin is loosely packed chromatin
 - (b) Heterochromatin is transcriptionally active
 - (c) Histone octomer is wrapped by negatively charged DNA in nucleosome
 - (d) Histones are rich in lysine and arginine
 - (e) A typical nucleosome contains 400 bp of DNA helix

Choose the correct answer from the options given below:

Sol. (1)

NCERT 12th Page No. 99, 100

Sol. (2)

NCERT 12th Page No. 271

- 120.** The process of translation of mRNA to proteins begins as soon as :
- (1) The larger subunit of ribosome encounters mRNA
 - (2) Both the subunits join together to bind with mRNA
 - (3) The tRNA is activated and the larger subunit or ribosome encounters mRNA
 - (4) The small subunit of ribosome encounters mRNA

Sol. (4)

NCERT 12th Page No. 115

- 121.** Identify the incorrect statement related to pollination
- (1) Pollination by wind is more common among abiotic pollination
 - (2) Flowers produce foul odours to attract flies and beetles to get pollinated
 - (3) Moths and butterflies are the most dominant pollinating agents among insects
 - (4) Pollination by water is quite rare in flowering plants

Sol. (3)

NCERT 12th Page No. 29, 30

- 122.** The gaseous plant growth regulator is used in plants to :
- (1) Promote root growth and roothair formation to increase the absorption surface
 - (2) Help overcome apical dominance
 - (3) Kill dicotyledonous weeds in the fields
 - (4) Speed up the malting process

Sol. (1)

NCERT 11th Page No. 250

- 123.** Which one of the following produces nitrogen fixing nodules on the roots of Alnus ?
- | | |
|------------------|--------------------|
| (1) Frankia | (2) Rhodospirillum |
| (3) Beijernickia | (4) Rhizobium |

Sol. (1)

NCERT 11th Page No. 102

124. What amount of energy is released from glucose during lactic acid fermentation ?

- | | |
|-------------------|-----------------------|
| (1) More than 18% | (2) About 10 % |
| (3) Less than 7 % | (4) Approximately 15% |

Sol. (3)

NCERT 11th Page No. 230

125. Habitat loss and fragmentation, over exploitation, alien species invasion and co-extinction are cause for :

- | | |
|-----------------|--------------------------|
| (1) Competition | (2) Biodiversity loss |
| (3) Natality | (4) Population explosion |

Sol. (2)

NCERT 12th Page No. 264, 265

126. Given below are two statements : one is labelled as

Assertion (A) and the other is labelled as Reason (R).

Assertion (A) :

Polymerase chain reaction is used in DNA amplification

Reason (R) :

The ampicillin resistant gene is used as a selectable marker to check transformation

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

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

Sol. (1)

NCERT 12th Page No. 199, 200, 202

127. Identify the correct set of statements :

- (a) The leaflets are modified into pointed hard thorns in Citrus and Bougainvillea
- (b) Axillary buds form slender and spirally coiled tendrils in cucumber and pumking
- (c) Stem is flattened and fleshy in Opuntia and modified to perform the function of leaves
- (d) Rhizophora shows vertically upward growing roots that help to get oxygen for respiration
- (e) Subaerially growing stems in grasses and strawberry help in vegetative propagation

Choose the correct answer from the options given below :

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

Sol. (2)

NCERT 11th Page No. 67, 68, 69, 71

128. "Girdling Experiment" was performed by plant physiologists to identify the plant tissue through which :

- (1) Food is transported
- (2) For both water and food transportation
- (3) Osmosis is observed
- (4) Water is transported

Sol. (1)

NCERT 11th Page No. 192

129. Which one of the following statement is not true regarding gel electrophoresis technique?

- (1) The separated DNA fragments are stained by using ethidium bromide.
- (2) The presence of chromogenic substrate gives blue coloured DNA bands on the gel.
- (3) Bright orange coloured bands of DNA can be observed in the gel when exposed to UV light.
- (4) The process of extraction of separated DNA strands from gel is called elution.

Sol. (2)

NCERT 12th Page No. 198

130. XO type of sex determination can be found in :

- (1) Birds
- (2) Grasshoppers
- (3) Monkeys
- (4) Drosophila

Sol. (2)

NCERT 12th Page No. 86

Sol. (2)

NCERT 11th Page No. 149

Sol. (2)

NCERT 11th Page No. 33

133. Which one of the following is not true regarding the release of energy during ATP synthesis through chemiosmosis? It involves :

 - (1) Breakdown of electron gradient
 - (2) Movement of protons across the membrane to the stroma
 - (3) Reduction of NADP to NADPH_2 on the stroma side of the membrane
 - (4) Breakdown of proton gradient

Sol. (1)

NCERT 11th Page No. 213, 214, 215

134. Which of the following is not observed during apoplastic pathway?

 - The movement does not involve crossing of cell membrane
 - The movement is aided by cytoplasmic streaming
 - Apoplast is continuous and does not provide any barrier to water movement
 - Movement of water occurs through intercellular spaces and wall of the cells.

Sol. (2)

NCERT 11th Page No. 184, 185

(3)

(1)

Section – B

Sol. (1)

Sol. (1)

NCERT 12th Page No. 89, 90, 91

- 138.** While explaining interspecific interaction of population (+) sign is assigned for beneficial interaction, (-) sign is assigned for detrimental interaction and (0) for neutral interaction. Which of the following interactions can be assigned (+) for one species and (-) for another species involved in the interaction?

Sol. (4)

NCERT 12th Page No. 232

139. In the following palindromic base sequences of DNA, which one can be cut easily by particular restriction enzyme?

- (1) 5' G A T T C 3'; 3' C T T A A G 5'
 (2) 5' C T C A G T 3'; 3' G A G T C A 5'
 (3) 5' G T A T T C 3'; 3' C A T A A G 5'
 (4) 5' G A T A C T 3'; 3' C T A T G A 5'

Sol. (1)

(1) NCERT 12th Page No. 196, 197

- 140.** The entire fleet of buses in Delhi were converted to CNG from diesel. In reference to this, which one of the following statements is false?

- following statements is false.

 - (1) The same diesel engine is used in CNG buses making the cost of conversion low
 - (2) It is cheaper than diesel
 - (3) It can not be adulterated like diesel
 - (4) CNG burns more efficiently than diesel

Sol. (1)

NCERT 12th Page No. 272, 273

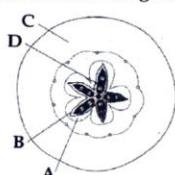
Sol. (4)

NCERT 12th Page No. 119

Sol. (1)

(1) NCERT 11th Page No. 179, 180

- 143.** Which part of the fruit, labelled in the given figure makes it a false fruit?



- (1) B → Endocarp (2) C → Thalamus (3) D → Seed (4) A → Mesocarp

Sol. (2)

NCERT 12th Page No. 37

- 144.** Given below are two statements : one is labelled as

Assertion (A) and the other is labelled as Reason (R).

Assertion (A) :

Mendel's law of Independent assortment does not hold good for the genes that are located closely on the same chromosome.

Reason (R) :

Closely located genes assort independently

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

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

 - (1) Both (A) and (R) are correct but (R) is not the correct explanation of (A)
 - (2) (A) is correct but (R) is not correct
 - (3) (A) is not correct but (R) is correct
 - (4) Both (A) and (R) are correct and (R) is the correct explanation of (A)

Sol. (2)

NCERT 12th Page No. 80

145. Read the following statements on lipids and find out correct set of statements :

- (a) Lecithin found in the plasma membrane is a glycolipid
- (b) Saturated fatty acids possess one or more c = c bonds
- (c) Gingelly oil has lower melting point, hence remains as oil in winter
- (d) Lipids are generally insoluble in water but soluble in some organic solvents
- (e) When fatty acid is esterified with glycerol, monoglycerides are formed

Choose the correct answer from the options given below :

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

Sol. (2)

NCERT 11th Page No. 144

146. What is the role of large bundle sheath cells found around the vascular bundles in C₄ plants ?

- (1) To increase the number of chloroplast for the operation of Calvin cycle
- (2) To enable the plant to tolerate high temperature
- (3) To protect the vascular tissue from high light intensity
- (4) To provide the site for photorespiratory pathway

Sol. (1)

NCERT 11th Page No. 218

147. Match the plant with the kind of life cycle it exhibits :

	List-I		List-II
(a)	Spirogyra	(i)	dominant diploid sporophyte vascular plant, with highly reduced male or female gametophyte
(b)	Fern	(ii)	Dominant haploid free-living gametophyte
(c)	Funaria	(iii)	Dominant diploid sporophyte alternating with reduced gametophyte called prothallus
(d)	Cycas	(iv)	Dominant haploid leafy gametophyte alternating with partially dependent multicellular sporophyte

Choose the correct answer from the options given below :

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

Sol. (1)

NCERT 11th Page No. 34 - 39

Sol. (2)

NCERT 12th Page No. 254

149. The anatomy of springwood shows some peculiar features. Identify the correct set of statements about springwood.

 - (a) It is also called as the earlywood
 - (b) In spring season cambium produces xylem elements with narrow vessels
 - (c) It is lighter in colour
 - (d) The springwood along with autumnwood shows alternate concentric rings forming annual rings
 - (e) It has lower density

Choose the correct answer from the options given below:

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

Sol. (1)

NCERT 11th Page No. 96

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

(a)	Metacentric chromosome	(i)	Centromere situated close to the end forming one extremely short and one very long arms
(b)	Acrocentric chromosome	(ii)	Centromere at the terminal end
(c)	Sub-metacentric	(iii)	Centromere in the middle forming two equal arms of chromosomes
(d)	Telocentric Chromosome	(iv)	Centromere slightly away from the middle forming one shorter arm and one longer arm

Choose the correct answer from the options given below:

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

Sol. (4)

NCERT 11th Page No. 139

ZOOLOGY

Section – A

- 151.** In gene therapy of Adenosine Deaminase (ADA) deficiency, the patient requires periodic infusion of genetically engineered lymphocytes because :

 - (1) Gene isolated from marrow cells producing ADA is introduced into at embryonic stages
 - (2) Lymphocytes from patient's blood are grown in culture, outside the body.
 - (3) Genetically engineered lymphocytes are not immortal cells.
 - (4) Retroviral vector is introduced into these lymphocytes.

Sol. (3)

NCERT 12th Page No. 211

Sol. (4)

NCERT 12th Page No. 266

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

Assertion (A) :

Osteoporosis is characterised by decreased bone mass and increased chances of fractures.

Reason (R) :

(2) Conserve only endangered species

(4) Protect and conserve the whole ecosystem

Common cause of osteoporosis is increased levels of estrogen.

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

(1) Both (A) and (R) are correct but (R) is not the correct explanation of (A)

(2) (A) is correct but (R) is not correct

(3) (A) is not correct but (R) is correct

(4) Both (A) and (R) are correct and (R) is the correct explanation of (A)

Sol. (2)

- 154.** Which of the following is a **correct** match for disease and its symptoms?

(1) Tetany – high Ca^{2+} level causing rapid spasms.

(2) Myasthenia gravis – Genetic disorder resulting in weakening and paralysis of skeletal muscle

(3) Muscular dystrophy – An auto immune disorder causing progressive degeneration of skeletal muscle

(4) Arthritis – Inflamed joints

Sol. (4)

- 155.** In the taxonomic categories which hierarchical arrangement in ascending order is **correct** in case of animals?
- (1) Kingdom, Class, Phylum, Family, Order, Genus, Species
 - (2) Kingdom, Order, Class, Phylum, Family, Genus, Species
 - (3) Kingdom, Order, Phylum, Class, Family, Genus, Species
 - (4) Kingdom, Phylum, Class, Order, Family, Genus, Species

Sol. **(4)**

NCERT 11th Page No. 10

- 156.** Regarding Meiosis, which of the statements is **incorrect**?
- (1) DNA replication occurs in S phase of Meiosis-II
 - (2) Pairing of homologous chromosomes and recombination occurs in Meiosis-I
 - (3) Four haploid cells are formed at the end of Meiosis-II
 - (4) There are two stages in Meiosis, Meiosis-I and II

Sol. **(1)**

NCERT 11th Page No. 167

- 157.** If the length of a DNA molecule is 1.1 metres, what will be the approximate number of base pairs?
- (1) 6.6×10^9 bp
 - (2) 3.3×10^6 bp
 - (3) 6.6×10^6 bp
 - (4) 3.3×10^9 bp

Sol. **(4)**

NCERT 12th Page No. 99

- 158.** Given below are two statements :

Statement I :

The coagulum is formed of network of threads called thrombins.

Statements II :

Spleen is the graveyard of erythrocytes.

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 incorrect
- (2) **Statement I** is correct but **Statement II** is incorrect
- (3) **Statement I** is incorrect but **Statement II** is correct
- (4) Both **Statement I** and **Statement II** are correct

Sol. **(3)**

- 159.** Given below are two statements :

Statement I :

Mycoplasma can pass through less than 1 micron filter size.

Statement II :

Mycoplasma are bacteria with cell wall

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 incorrect
- (2) **Statement I** is correct but **Statement II** is incorrect
- (3) **Statement I** is incorrect but **Statement II** is correct
- (4) both **Statement I** and **Statement II** are correct

Sol. (2)

NCERT 11th Page No. 20

- 160.** If '8' Drosophila in laboratory population of '80' died during a week, the death rate in the population is _____ individuals per Drosophila per week.

- (1) 10
- (2) 1.0
- (3) zero
- (4) 0.1

Sol. (4)

NCERT 12th Page No. 83

- 161.** A dehydration reaction links two glucose molecules to produce maltose. If the formula for glucose is $C_6H_{12}O_6$ then what is the formula for maltose ?

- (1) $C_{12}H_{24}O_{12}$
- (2) $C_{12}H_{22}O_{11}$
- (3) $C_{12}H_{24}O_{11}$
- (4) $C_{12}H_{20}O_{10}$

Sol. (2)

- 162.** Tegmina in cockroach, arises from :

- (1) Mesothorax
- (2) Metathorax
- (3) Prothorax and Mesothorax
- (4) Prothorax

Sol. (1)

- 163.** Identify the microorganism which is responsible for the production of an immunosuppressive molecule cyclosporin A :

- (1) Clostridium butylicum
- (2) Aspergillus niger
- (3) Streptococcus cerevisiae
- (4) Trichoderma polysporum

Sol. (4)

NCERT 12th Page No. 181

- 170.** Given below are statements :

Statement I :

Autoimmune disorder is a condition where body defense mechanism recognizes its own cells as foreign bodies.

Statement II :

Rheumatoid arthritis is a condition where body does not attack self cells.

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

- (1) Both **statement I** and **statement II** are incorrect
- (2) **Statement I** is correct but **statement II** is incorrect
- (3) **Statement I** is incorrect but **statement II** is correct
- (4) Both **statement I** and **statement II** are correct

Sol. (2)

- 171.** Under normal physiological conditions in human being every 100ml of oxygenated blood can deliver _____ ml of O₂ to the tissues.

- (1) 5 ml
- (2) 4 ml
- (3) 10 ml
- (4) 2 ml

Sol. (1)

- 172.** In an E.coli strain i gene gets mutated and its product can not bind the inducer molecule. If growth medium is provided with lactose, what will be the outcome ?

- (1) z, y, a genes will be transcribed
- (2) z, y, a genes will not be translated
- (3) RNA polymerase will bind the promoter region
- (4) Only z gene will get transcribed

Sol. (2)

NCERT 12th Page No. 116, 117

- 173.** Which of the following is present between the adjacent bones of the vertebral column ?

- (1) Cartilage
- (2) Areolar tissue
- (3) Smooth muscle
- (4) Intercalated discs

Sol. (1)

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

Assertion (A)

All vertebrates are chordates but all chordates are not vertebrates.

Reason (R) :

Notochord is replaced by vertebral column in the adult vertebrates.

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

- (1) Both (A) and (R) are correct but (R) is not the correct explanation of (A)
- (2) (A) is correct but (R) is not correct
- (3) (A) is not correct but (R) is correct
- (4) Both (A) and (R) are correct and (R) is the correct explanation of (A)

Sol. (4)

- 175.** Given below are two statements :

Statement I :

The release of sperms into the seminiferous tubules is called spermiation.

Statement II :

Spermiogenesis is the process of formation of sperm from spermatogonia.

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 incorrect
- (2) **Statement I** is correct but **statement II** is incorrect
- (3) **Statement I** is incorrect but **statement II** is correct
- (4) Both **statement I** and **statement II** are correct.

Sol. (2)

- 176.** Identify the asexual reproductive structure associated with Penicillium :

- | | |
|-------------|---------------|
| (1) Conidia | (2) Gemmules |
| (3) Buds | (4) Zoospores |

Sol. (1)

NCERT 12th Page No. 6

- 177.** Which of the following statements are true for spermatogenesis but do not hold true for Oogenesis ?
- (a) It results in the formation of haploid gametes
 - (b) Differentiation of gamete occurs after the completion of meiosis
 - (c) Meiosis occurs continuously in a mitotically dividing stem cell population.
 - (d) It is controlled by the Luteinising hormone (LH) and Follicle Stimulating Hormone (FSH) secreted by the anterior pituitary
 - (e) It is initiated at puberty

Choose the most appropriate answer from the options given below :

- (1) (b) and (c) only
- (2) (b), (d) and (e) only
- (3) (b), (c) and (e) only
- (4) (c) and (e) Only

Sol. (3)

- 178.** Given below are two statements :

Statement I :

Restriction endonucleases recognise specific sequence to cut DNA known as palindromic nucleotide sequence.

Statement II :

Restriction endonucleases cut the DNA strand a little away from the centre of the palindromic site

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 incorrect
- (2) **Statement I** is correct but **statement II** is incorrect
- (3) **Statement I** is incorrect but **statement II** is correct
- (4) Both **statement I** and **statement II** are correct

Sol. (4)

NCERT 12th Page No. 196, 197

- 179.** Lippe's loop is a type of contraceptive used as :
(1) Vault barrier (2) Non-Medicated IUD
(3) Copper releasing IUD (4) Cervical barrier

SOL. (2)

Sol. (1)

NCERT 12th Page No. 243, 244

Sol. (3)

NCERT 11th Page No. 102, 103

- 182.** In which of the following animals, digestive tract has additional chambers like crop and gizzard ?

 - (1) Bufo, Balaenoptera, Bangarus
 - (2) Catla, Columba, Crocodilus
 - (3) Pavo, Psittacula, Corvus
 - (4) Corvus, Columba, Chameleon

(4)

[3] NCFERT 113, B N 52, 53

- 183** Given below are two statements:

Statement I

Statement I: Fatty acids and glycerols cannot be absorbed into the blood.

Fatty acids and **Statement II**

Statement II: Specialized lymphatic capillaries called lacteals carry chylomicrons into lymphatic vessels and ultimately into the blood.

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

- In the light of the above statements, choose the most appropriate:

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

Sol (4)

NCFERT 11th Page No. 265

184. Select the incorrect statement with reference to mitosis :

- (1) Spindle fibres attach to centromere of chromosomes
- (2) Chromosomes decondense at telophase.
- (3) Splitting of centromere occurs at anaphase.
- (4) All the chromosomes lie at the equator at metaphase.

Sol. (1)

NCERT 11th Page No. 164, 165, 167

185. At which stage of life the oogenesis process is initiated ?

- (1) Embryonic development stage
- (2) Birth
- (3) Adult
- (4) Puberty

Sol. (1)

NCERT 12th Page No. 48

Section-B

186. The recombination frequency between the genes a & c is 5%, b & c is 15%, b & d is 9%, a & b 20%, c & d is 24% and a & d is 29%. What will be the sequence of these genes on a linear chromosome ?

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

Sol. (3)

NCERT 12th Page No. 83, 84

187. Which one of the following statements is correct ?

- (1) The tricuspid and the bicuspid valves open due to the pressure exerted by the simultaneous contraction of the atria
- (2) Blood moves freely from atrium to the ventricle during joint diastole.
- (3) Increased ventricular pressure causes closing of the semilunar valves.
- (4) The atrio-ventricular node (AVN) generates an action potential to stimulate atrial contraction

Sol. (2)

NCERT 11th Page No. 284, 285

188. Given below are two statements :

Statement I :

In a scrubber the exhaust from the thermal plant is passed through the electric wires to charge the dust particles.

Statement II :

Particulate matter (PM 2.5) can not be removed by scrubber but can be removed by an electrostatic precipitator.

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 incorrect
- (2) **Statement I** is correct but **Statement II** is incorrect
- (3) **Statement I** is incorrect but **Statement II** is correct
- (4) Both **Statement I** and **Statement II** are correct

Sol. (3)

NCERT 12th Page No. 271

189. Match List-I with List-II

List-I

- (a) Bronchioles
- (b) Goblet cell
- (c) Tendons
- (d) Adipose Tissue

List-II

- (i) Dense Regular Connective tissue
- (ii) Loose Connective Tissue
- (iii) Glandular Tissue
- (iv) Ciliated Epithelium

Choose the correct answer from the options given below :

- (1) (a) – (i), (b) – (ii), (c) – (iii), (d) – (iv)
- (2) (a) – (ii), (b) – (i), (c) – (iv), (d) – (iii)
- (3) (a) – (iii), (b) – (iv), (c) – (ii), (d) – (i)
- (4) (a) – (iv), (b) – (iii), (c) – (i), (d) – (ii)

Sol. (4)

NCERT 11th Page No. 102, 103

190. Ten E.coli cells with ^{15}N -dsDNA are incubated in medium containing ^{14}N nucleotide. After 60 minutes, how many E.coli cells will have DNA totally free from ^{15}N ?

- (1) 40 cells
- (2) 60 cells
- (3) 80 cells
- (4) 20 cells

Sol. (2)

NCERT 12th Page No. 104, 105

191. Select the incorrect statement regarding synapses :

- (1) Electrical current can flow directly from one neuron into the other across the electrical synapse.
- (2) Chemical synapses use neurotransmitters
- (3) Impulse transmission across a chemical synapse is always faster than that across an electrical synapse.
- (4) The membranes of presynaptic and postsynaptic neurons are in close proximity in an electrical synapse.

Sol. (3)

NCERT 11th Page No. 319

192. Which of the following are **not** the effects of parathyroid hormone ?

- (a) Stimulates the process of bone resorption
- (b) Decreases Ca^{2+} level in blood
- (c) Reabsorption of Ca^{2+} by renal tubules
- (d) Decreases the absorption of Ca^{2+} from digested food
- (e) Increases metabolism of carbohydrates

Choose the most appropriate answer from the options given below :

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

Sol. (1)

NCERT 11th Page No. 334

193. Which of the following statements is not true ?

- (1) Sweet potato and potato is an example of analogy
- (2) Homology indicates common ancestry
- (3) Flippers of penguins and dolphins are a pair of homologous organs
- (4) Analogous structures are a result of convergent evolution

Sol. (3)

NCERT 12th Page No. 130, 131

194. If a colour blind female marries a man whose mother was also colour blind , what are the chances of her progeny having colour blindness ?

- (1) 50 %
- (2) 75 %
- (3) 100 %
- (4) 25 %

Sol. (3)

NCERT 12th Page No. 89

195. Which of the following is a **correct** statement ?

- (1) Bacteria are exclusively heterotrophic organisms
- (2) Slime moulds are saprophytic organisms classified under Kingdom Monera.
- (3) Mycoplasma have DNA, Ribosome and cell wall
- (4) Cyanobacteria are a group of autotrophic organisms classified under kingdom Monera.

Sol. (4)

NCERT 11th Page No. 20

196. Match List-I with List-II.

List-I (Biological Molecules)	List-II (Biological functions)
(a) Glycogen	(i) Hormone
(b) Globulin	(ii) Biocatalyst
(c) Steroids	(iii) Antibody
(d) Thrombin	(iv) Storage product

Choose the **correct answer** from the options given below :

- (1) (a) – (iv), (b) – (ii), (c) – (i), (d) – (iii)
- (2) (a) – (ii), (b) – (iv), (c) – (iii), (d) – (i)
- (3) (a) – (iv), (b) – (iii), (c) – (i), (d) – (ii)
- (4) (a) – (iii), (b) – (ii), (c) – (iv), (d) – (i)

Sol. (3)

NCERT 11th Page No. 130, 131

197. Which of the following is **not** a desirable feature of a cloning vector?

- (1) Presence of a marker gene.
- (2) Presence of single restriction enzyme site
- (3) Presence of two or more recognition sites
- (4) Presence of origin of replication

Sol. (3)

NCERT 12th Page No. 198, 199, 200

198. Match List-I with List-II with respect to methods of Contraception and their respective actions.

List-I	List-II
(a) Diaphragms	(i) Inhibit ovulation and Implantation
(b) Contraceptive Pills	(ii) Increase phagocytosis of sperm within uterus
(c) Intra Uterine Devices	(iii) Absence of Menstrual cycle and ovulation following parturition
(d) Lactational Amenorrhea	(iv) They cover the cervix blocking the entry of sperms

Choose the correct answer from the options given below :

- (1) (a) – (iv), (b) – (i), (c) – (ii), (d) – (iii)
- (2) (a) – (ii), (b) – (iv), (c) – (i), (d) – (iii)
- (3) (a) – (iii), (b) – (ii), (c) – (i), (d) – (iv)
- (4) (a) – (iv), (b) – (i), (c) – (iii), (d) – (ii)

Sol. (1)

NCERT 12th Page No. 60, 61

199. Statements related to human insulin are given below:

Which statement (s) is/are **correct** about genetically engineered Insulin?

- (a) Pro-hormone insulin contain extra stretch of C-peptide.
- (b) A-peptide and B-peptide chains of insulin were produced separately in E.coli, extracted and combined by creating disulphide bond between them.
- (c) Insulin used for treating Diabetes was extracted from Cattles and Pigs.
- (d) Pro-hormone Insulin needs to be processed for converting into a mature and functional hormone.
- (e) Some patients develop allergic reactions to the foreign insulin.

Choose the **most appropriate** answer from the options given below :

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

Sol. (1)

NCERT 12th Page No. 210, 211

200. Select the **incorrect** statement with respect to acquired immunity.

- (1) Anamnestic response is elicited on subsequent encounters with the same pathogen.
- (2) Anamnestic response is due to memory of first encounter.
- (3) Acquired immunity is non-specific type of defense present at the time of birth
- (4) Primary response is produced when our body encounters a pathogen for the first time.

Sol. (3)

NCERT 12th Page No. 151