NEET 2022 Answer Keys with Solutions

Section-A (Physics)

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

(1) $5\ \text{m}$

(2) $\frac{10}{3}\ \text{m}$

(3) $\frac{20}{3}\ \text{m}$

(4) $10\ \text{m}$

Answer: (3)

Explanation:

The centre of mass from $10\ \text{kg}$ is calculated as,

$$\text{COM}, x = \frac{10(0) + 20 \times 10}{20 + 30}$$

$$x = \frac{200}{30} = \frac{20}{3}\ \text{m}$$

Chapter Name: System of Particles and Rotational Motion

2. Match List - I with List - II:

List-I (Electromagnetic waves)		List – II (Wavelength)	
(a)	AM radio waves	(i)	$10^{-10}\ \text{m}$
(b)	Microwaves	(ii)	$10^{2}\ \text{m}$
(c)	Infrared radiations	(iii)	$10^{-2}\ \text{m}$
(d)	X-rays	(iv)	$10^{-4}\ \text{m}$

Choose the correct answer from the options given below:

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

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

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

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

Answer: (1)

Explanation:

The order of wavelength of EM wave radiations is,

$\lambda(X\text{-ray}) < \lambda(\text{infra}) < \lambda(\text{micro}) < \lambda(\text{AM})$

$\Rightarrow \quad 10^{-10} \angle 10^{-4}\,\text{m} \angle 10^{-2}\,\text{m} \angle 10^{2}\,\text{m}$

Chapter Name: Electromagnetic Waves

3. The energy that will be ideally radiated by a $100\ \text{kW}$ transmitter in 1 hour is:

(1) $1\times10^{5}\,\text{J}$

(2) $36\times10^{7}\,\text{J}$

(3) $36\times10^{4}\,\text{J}$

(4) $36\times10^{5}\,\text{J}$

Answer: (2)

Explanation:

As we know that, $P = \frac{w}{t}$

$100\times10^{3} = \frac{w}{1}$

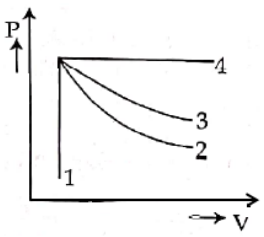
$w = 10^{5}\ \text{J}$

Energy emitted in one second $= 10^{5}\ \text{J}$

Energy emitted in one hour $= 36\times100\times10^{5}\ \text{J} = 36\times10^{7}\,\text{J}$

Chapter Name: Dual Nature of Radiation and Matter

4. 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) 4
(2) 1
(3) 2
(4) 3

Answer: (3)

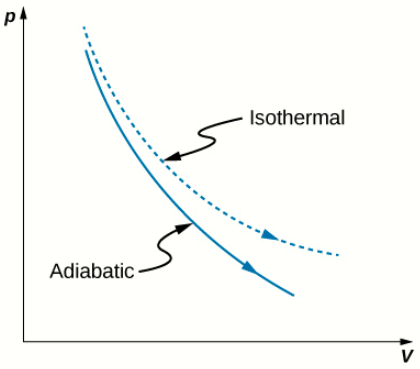
Explanation:

In thermodynamics, an adiabatic process is a type of thermodynamic process that occurs without transferring heat or mass between the thermodynamic system and its environment.

And we know that a quasi-static adiabatic expansion of an ideal gas produces a steeper pV curve than that of the corresponding isothermal (graph shown below).

From given graph, curve 4 is isobaric process, 1 is isochoric.

Thus, Curve 2 is a adiabatic process.



Chapter Name : Thermodynamics

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

Answer: (2)

Explanation:

$$\theta = \frac{\text{arc}}{\text{radius}}$$

S.I unit of angle is radian.

$$\Omega = \frac{\text{area}}{(\text{radius})^2}$$

S.I unit of solid angle is steradian.

Both the quantity has unit but no dimensions.

Chapter Name: Units and Measurements.

6. In half wave rectification, if the input frequency is $60\ \text{Hz}$, then the output frequency would be :

(1) $120\ \text{Hz}$
(2) Zero
(3) $30\ \text{Hz}$
(4) $60\ \text{Hz}$

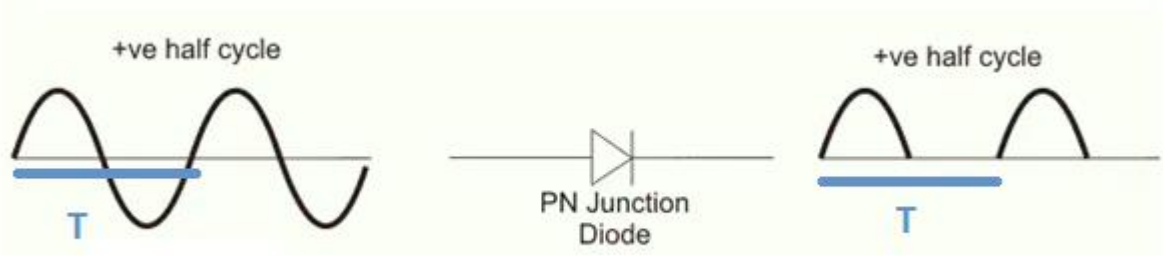
Answer: (4)

Explanation:

The output of half wave rectifier is shown below.

We can see from the shown figure that the time period of the both the graph is T. It means that they both will have same frequency.

Frequency, $f = \frac{1}{T}$



Chapter Name: Semiconductor Electronics: Materials, Devices and Simple Circuits

7. When two monochromatic lights of frequency, v and $\frac{v}{2}$ 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) $\frac{3}{2}v$

(2) $2v$

(3) $3v$

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

Answer: (1)

Explanation:

As we know that K.E = Work function – Threshold frequency

$$e\left(\frac{V_s}{2}\right) = hv - \phi \qquad \text{K}\ (1)$$

$$eV_s = h\left(\frac{v}{2}\right) - \phi \qquad \text{K}\ (2)$$

Now, substituting the values of equation (2) in (1),

$$\frac{1}{2}\left[\frac{hv}{2} - \phi\right] = hv - \phi$$

$$\frac{hv}{4} - \frac{\phi}{2} = hv - \phi$$

$$\frac{hv}{4} - hv = -\phi + \frac{\phi}{2}$$

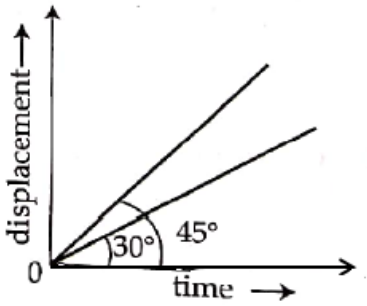
$$\frac{-3hv}{4} = \frac{-\phi}{2}$$

$$\phi = \frac{h(3v)}{2}$$

$$v' = \frac{3v}{2}$$

Chapter Name: Dual Nature of Radiation and Matter

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) $1:\sqrt{3}$

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

(3) $1:1$

(4) $1:2$

Answer: (1)

Explanation:

Velocity is defined as the slope of displacement - time graph,

$$\vec{V} = \frac{d\vec{s}}{dt} = \tan\theta$$

$\therefore \quad V_1 =$ Slope of $\vec{s} - t$ curve

$$V_1 = \tan\theta_1 \quad V_2 = \tan\theta_2$$

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

Chapter Name: Motion in a Plane

9. The dimensions $\left[\mathrm{MLT^{-2}A^{-2}}\right]$ belong to the:

(1) electric Permittivity

(2) magnetic flux

(3) self-inductance

(4) magnetic Permeability

Answer: (4)

Explanation:

The dimensional formula of magnetic field $[B]$ is,

$$[B] = \left[M T^{-2} A^{-1} \right]$$

The dimensional formula of magnetic field intensity is,

$$[H] = \left[M^{0} L^{-1} A \right]$$

We know that, the formula of Magnetic permeability is,

$$\mu = \frac{B}{H}$$

The dimensional formula is calculated as,

$$[\mu] = \frac{[B]}{[H]} = \frac{\left[M T^{-2} A^{-1} \right]}{\left[M^{0} L^{-1} A \right]} = \left[M L T^{-2} A^{-2} \right]$$

Chapter Name: Moving Charges and Magnetism, Magnetism and Matter

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

(1) $\frac{1}{\sqrt{2}}$ times the rms value of the ac source

(2) the value of voltage supplied to the circuit

(3) the runs value of the ac source

(4) $\sqrt{2}$ times the rms value of the ac source

Answer: (4)

Explanation:

The relationship between peak voltage and rms voltage is,

$$V_{rms} = \frac{V_{peak}}{\sqrt{2}} = \frac{V_0}{\sqrt{2}}$$

Chapter Name: Alternating Current

11. The ratio of the distances travelled by a freely falling body in the $1^{st}, 2^{nd}, 3^{rd}$ and 4^{th} second:

(1) $1:1:1:1$

(2) $1:2:3:4$

(3) $1:4:9:16$

(4) $1:3:5:7$

Answer: (4)

Explanation:

Distance travelled by a freely falling body in n^{th} second is,

$$S_n = \frac{a}{2}(2n-1)$$

For $n = 1 \Rightarrow S_1 = \frac{a}{2}(2\times 1-1) = \frac{a}{2}$

$$n = 2 \Rightarrow S_2 = \frac{a}{2}(2\times 2-1) = \frac{3}{2}a$$

$$n = 3 \Rightarrow S_3 = \frac{a}{2}(2\times 3-1) = \frac{5}{2}a$$

$$n = 4 \Rightarrow S_4 = \frac{a}{2}(2\times 4-1) = \frac{7a}{2}$$

$$\therefore S_1 : S_2 : S_3 : S_4 = 1:3:5:7$$

Chapter Name: Motion in a Straight Line

12. A body of mass $60\ g$ experiences a gravitational force of $3.0\ N$, when placed at a particular point. The magnitude of the gravitational field intensity at that Point is:
(1) $180\ N/kg$
(2) $0.05\ N/kg$
(3) $50\ N/kg$
(4) $20\ N/kg$

Answer: (3)

Explanation:

The gravitational force intensity $I = \frac{F}{m}$

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

Chapter Name: Gravitation

13. In the given nuclear reaction, the element X is:

$^{22}_{11}Na \rightarrow X + e^{+} + v$

(1) $^{22}_{12}Mg$

(2) $^{23}_{11}Na$

(3) $^{23}_{10}Ne$

(4) $^{22}_{10}Ne$

Answer: (4)

Explanation:

For β^{+} decay, $^{N}_{Z}X \rightarrow {}^{N}_{Z-1}Y + e^{+} + v$

Thus, our required nuclear reaction is,

$^{22}_{11}Na \rightarrow {}^{22}_{10}Ne + e^{+} + v$

Chapter Name: Nuclei

14. If a soap bubble expands, the pressure inside the bubble:

(1) is equal to the atmospheric pressure

(2) decreases

(3) increases

(4) remains the same

Answer: (2)

Explanation:

The excess pressure inside the soap bubble is,

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

From above, $P \propto \frac{1}{R}$

Chapter Name: Mechanical Properties of Fluids

15. Two resistors of resistance, $100\ \Omega$ and $200\,\Omega$ are connected in parallel in an electrical circuit. The ratio of the thermal energy developed in $100\ \Omega$ to that in $200\,\Omega$ in a given time is:

(1) $4:1$

(2) $1:2$

(3) $2:1$

(4) $1:4$

Answer: (3)

Explanation:

The formula of power when resistance is connected across the voltage source is,

$$P = \frac{V^2}{R}$$

Now, the power generated across the $100\ \Omega$ is,

$$P_{100\ \Omega} = \frac{V^2}{100}$$

The thermal energy developed for time t is, $E_{100} = \frac{V^2}{100} \times t$

The power generated across the $200\ \Omega$ is,

$$P_{200} = \frac{V^2}{200}$$

The thermal energy developed for time t is, $E_{200} = \frac{V^2}{200} \times t$

The ratio of thermal energy is,

$$P = \frac{V^2}{R}$$

$$E_{100} = \frac{V^2}{100} \times t$$

$$\frac{E_{100}}{E_{200}} = \frac{\frac{V^2}{100} \times t}{\frac{V^2}{200} \times t} = \frac{2}{1}$$

$$\frac{E_{100}}{E_{200}} = \frac{2}{1}$$

Chapter Name: Current Electricity

16. Two hollow conducting spheres of radii R_1 and R_2 $(R_1 >> R_2)$ have equal charges.

The potential would be:

(1) dependent on the material property of the sphere
(2) more on bigger sphere
(3) more on smaller sphere
(4) equal on both the spheres

Answer: (3)

Explanation:

The formula of potential drop on hollow conducting sphere is,

$$V = \frac{1}{4\pi\varepsilon_0}\left(\frac{Q}{R}\right)$$

$$V \propto \frac{1}{R}$$

As we can see that for same charge, potential is inversely proportional to radius.

Chapter Name: Electrostatic Potential and Capacitance

17. The angular speed of a fly wheel moving with uniform angular acceleration changes from $1200\ \text{rpm}$ to $3120\ \text{rpm}$ in 16 seconds. The angular acceleration in rad/s^2 is:

(1) 104π
(2) 2π
(3) 4π
(4) 12π

Answer: (3)

Explanation:

The initial angular velocity, $\omega_i = 1200\ \text{rpm}$

Or the initial angular velocity, $\omega_i = 1200 \times \frac{2\pi}{60} = 40\pi\ \text{rad/s}$

The final angular velocity is, $\omega_f = 3120\ \text{rpm} = 3120 \times \frac{2\pi}{60} = 104\pi\ \text{rad/s}$

Time is given as, $t = 16\ \text{s}$

The angular acceleration is, $\alpha = \frac{\omega_f - \omega_i}{t}$

$$\alpha = \frac{(104 - 40)\pi}{16} = 4\pi \text{ rad/s}^2$$

Chapter Name: System of Particles and Rotational Motion

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

(1) $v = \frac{c}{\sqrt{\varepsilon_r \mu_r}}$

(2) $v = c$

(3) $v = \sqrt{\frac{\mu_r}{\varepsilon_r}}$

(4) $v = \sqrt{\frac{\varepsilon_r}{\mu_r}}$

Answer: (1)

Explanation:

The velocity of electromagnetic radiation in an any medium is written as,

$$V = \frac{1}{\sqrt{\mu\varepsilon}} \quad \text{or C} = \frac{1}{\sqrt{\mu_0 \varepsilon_0}}$$

$$\text{and } \mu\varepsilon = \mu_r \varepsilon_r \mu_0 \varepsilon_0$$

$$\therefore V = \frac{1}{\sqrt{\mu\varepsilon}} = \frac{1}{\sqrt{\mu_r \varepsilon_r \mu_0 \varepsilon_0}} = \frac{C}{\sqrt{\mu_r \varepsilon_r}}$$

Chapter Name: Electromagnetic Waves

19. 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) $6.28 \times 10^{-4}\ T$

(2) $6.28 \times 10^{-2} T$

(3) $12.56 \times 10^{-2}\ T$

(4) $12.56 \times 10^{-4}\ T$

Answer: (3)

Explanation:

The formula of magnetic field strength for solenoid is $B = \mu_0 nI$.

The magnetic field strength for solenoid is calculated as,

$$B = 4\pi \times 10^{-7} \times \frac{100}{10^{-3}} \times 1$$

$$B = 12.56 \times 10^{-2}\,\text{T}$$

Chapter Name: Magnetism and Matter

20. A shell of mass m is at rest initially. It explodes into three fragments having 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) $3\sqrt{2}v$

(2) v

(3) $\sqrt{2}v$

(4) $2\sqrt{2}v$

Answer: (4)

Explanation:

As we know that $\sum \vec{F}_{ext} = 0$

$$p_i = p_f$$

In the question, the shell of mass m was at rest initially therefore $p_i = 0$ and $p_f = m_1 v_x \hat{i} + m_2 v_y \hat{j} + m_3 v_z \hat{k}$.

Now, substituting the values,

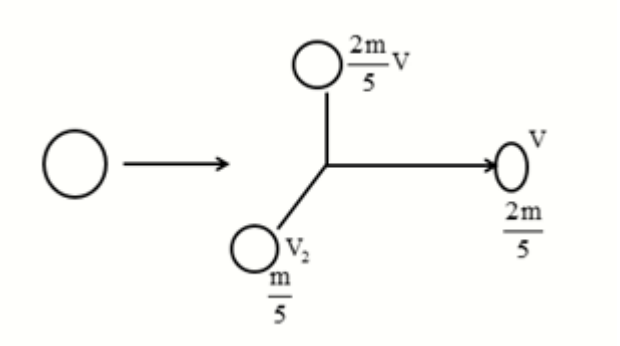
$$0 = \left(\frac{2}{5}\right) v\hat{i} + \left(\frac{2}{5}\right) v\hat{j} + \left(\frac{1}{5}\right) v_2 \hat{k} \qquad (v_z = v_2)$$

$$-v_2 \hat{k} = \left((2)\, v\hat{i} + (2)\, v\hat{j}\right)$$

Speed of particle is always equal to modulus of the velocity.

$$|v_2| = \sqrt{(2v)^2 + (2v)^2}$$

$$|v_2| = 2\sqrt{2}v$$



Chapter Name: System of Particles and Rotational Motion

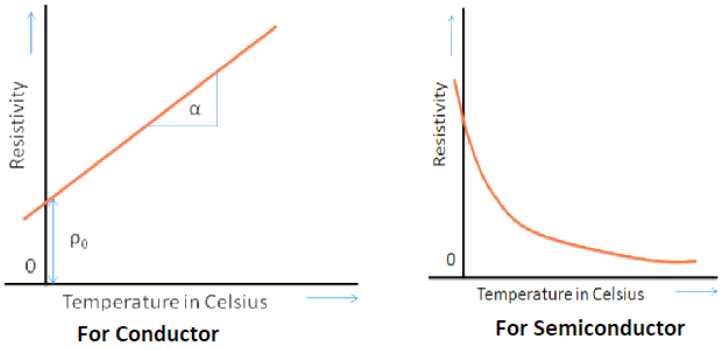
21. As the temperature increases, the electrical resistance:
    (1) decreases for conductors but increases for semiconductors
    (2) increases for both conductors and semiconductors
    (3) decreases for both conductors and semiconductors
    (4) increases for conductors but decreases for semiconductors

Answer: (4)

Explanation:

Conductor: With rise in temperature rms speed of free electrons inside the conductor increase, so relaxation time decrease and hence resistance increase. For conductors α is $(+)$ ve.

Semiconductor: The resistance is inversely proportional to temperature because α is $(-)$ ve.



Chapter Name: Current Electricity

22. A biconvex lens has radii of curvature, $20\ \text{cm}$ each. If the refractive index of the material of the lens is 1.5, the power of the lens is:

(1) Infinity

(2) $+2D$

(3) $+20D$

(4) $+5D$

Answer: (4)

Explanation:

Using lens maker formula $\frac{1}{f} = (\mu - 1)\left[\frac{1}{R_1} - \frac{1}{R_2}\right]$

$$\Rightarrow \frac{1}{f} = (1.5-1)\left[\frac{1}{20} - \left(\frac{1}{-20}\right)\right]$$

$$\frac{1}{f} = (1.5-1)\left[\frac{1}{20} + \frac{1}{20}\right] = 0.5 \times \frac{2}{20}$$

$$\frac{1}{f} = 0.5 \times \frac{1}{10} = \frac{5}{100} = \frac{1}{20}$$

$$f = 20\ \text{cm} = 0.2\ \text{m}$$

$$P = \frac{1}{f} = \frac{1}{0.2} = 5\ \text{D}$$

Chapter Name: Ray Optics and Optical Instruments

23. 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) **Statement I** is incorrect and **Statement II** is correct

(2) Both **Statement I** and **Statement II** are correct

(3) Both **Statement I** and **Statement II** are incorrect

(4) **Statement I** is correct and **Statement II** is incorrect

Answer: (4)

Explanation:

According to the Biot Savart law,

$$dB = \frac{\mu_0 \left(I\vec{dl} \times \vec{r} \right)}{4\pi r^3}$$

In the above expression, $I\vec{dl}$ and $\vec{r}$ are vector quantity and magnetic field depends upon the product of these quantities.

Option II is wrong statement.

Thus, option I is correct but option II is incorrect.

Chapter Name: Moving Charges and Magnetism

24. A square loop of side $1\ \text{m}$ and resistance 1Ω is placed in a magnetic field of $0.5\ T$. If the plane of loop is perpendicular to the direction of magnetic field, the magnetic flux through the loop is:
(1) zero weber
(2) 2 weber
(3) 0.5 weber
(4) 1 weber

Answer: (3)

Explanation:

The formula of magnetic flux is

$$\phi = \vec{B} \cdot \vec{A}$$

Flux is calculated as,

$$\phi = 0.5 \times (1)^2 \cos 0^\circ$$

$$\phi = 0.5\,\text{weber}$$

Chapter Name: Magnetism and Matter

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

$\left(\text{g} = 10\ \text{ms}^{-2}\right)$

(1) 23500

(2) 23000

(3) 20000

(4) 34500

Answer: (4)

Explanation:

According to Newton's second law, object is moving with constant speed therefore we can say,

Upward force $=$ downward force

$$F = mg + f$$

$$F = 2000 \times 10 + 3000$$

$$F = 23000\ \text{N}$$

The upward distance covered in one second is $1.5\ \text{m}$.

Thus, the work -done is,

$$W = F \times d$$

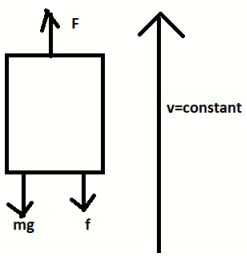
$$W = 23000 \times 1.5$$

$$W = 34500\ \text{J}$$

The power of motor is,

$$P = \frac{W}{T} = \frac{34500}{1}$$

$$P = 34500\ \text{Watt}$$



Chapter Name: Work, Energy, and Power

26. 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) $120°$

(2) $30°$

(3) $60°$

(4) $90°$

Answer: (4)

Explanation:

Applying Snell's law,

$$\sin 60^{\circ} \times 1 = \sqrt{3} \sin r$$

$$\sin r = \frac{\sin 60^{\circ} \times 1}{\sqrt{3}}$$

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

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

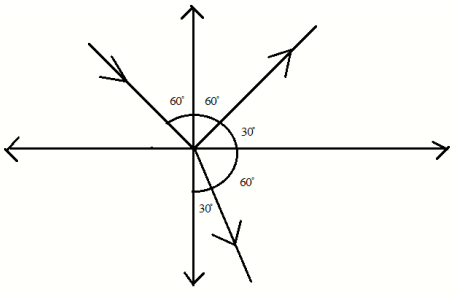
$$r = 30^{\circ}$$

The reflected ray will make 60° from the normal.

Thus, the angle between reflected ray and transmitted ray will be,

$$\theta = 60^{\circ} + 30^{\circ}$$

$$\theta = 90^{\circ}$$



Chapter Name: Ray Optics and Optical Instruments

27. A copper wire of length $10\ \text{m}$ and radius $\left(\frac{10^{-2}}{\sqrt{\pi}}\right)\ \text{m}$ has electrical resistance of $10\,\Omega$.

The current density in the wire for an electric field strength of $10\ (\text{V/m})$ is:

(1) $10^{5}\ \text{A}/\text{m}^{2}$

(2) $10^{4}\ \text{A}/\text{m}^{2}$

(3) $10^{6}\ \text{A/m}^{2}$

(4) $10^{-5}\ \text{A}/\text{m}^{2}$

Answer: (1)

Explanation:

The formula of resistance is, $R = \frac{\rho l}{A}$

$$10 = \frac{\rho(10)}{\pi \times \left(\frac{10^{-2}}{\sqrt{\pi}}\right)^{2}}$$

$$\rho = 10^{-4}\ \Omega.\text{m}$$

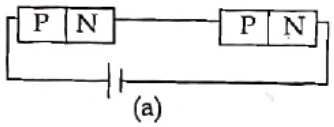
Conductivity, $\sigma = \frac{1}{\rho} = \frac{1}{10^{-4}} = 10^{4}\ \text{mho}$

Current density, $J = \sigma E$

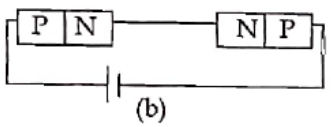
$$J = 10^{4} \times 10 = 10^{5}\ \text{A/m}^{2}$$

Chapter Name: Current Electricity

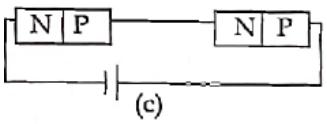
28.



(a)



(b)



(c)

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

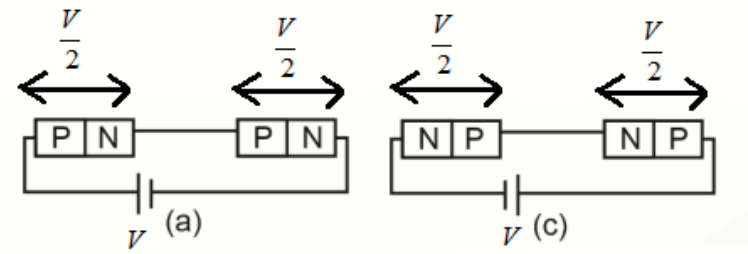
(1) Both circuits (a) and (c)
(2) Circuit (a) only
(3) Circuit (b) only
(4) Circuit (c) only

Answer: (1)

Explanation:

The figure (a) and figure (c) are in forward bias. The external potential is divided equally in both of the $p-n$ junction diode.

The circuit diagram is shown below,



Chapter Name: Semiconductor Electronics: Materials, Devices and Simple Circuits

29. If the initial tension on a stretched string is doubled, then the ratio of the initial and final speeds of a transverse wave along the string is:
(1) $1:2$
(2) $1:1$
(3) $\sqrt{2}:1$
(4) $1:\sqrt{2}$

Answer: (4)

Explanation:

Speed of wave in a string is, $V = \sqrt{\frac{T}{\mu}}$

$T =$ Tension & $\mu =$ mass per unit length

For same material (or same string)

$\therefore V \propto \sqrt{T}$

$$\frac{V_i}{V_f} = \sqrt{\frac{T_i}{T_f}} = \frac{1}{\sqrt{2}}$$

Chapter Name: Waves

30. 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) $1:\sqrt{2}$

(2) $2:1$

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

(4) $4:1$

Answer: (3)

Explanation:

As we know that, $k = \sqrt{\frac{I}{M}}$

$$\frac{k_1}{k_2} = \sqrt{\frac{I_1}{I_2}} = \sqrt{\frac{m\frac{R^2}{2}}{m\frac{R^2}{4}}} = \sqrt{\frac{2}{1}}$$

Chapter Name: System of Particles and Rotational Motion

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

(1) 12

(2) 6

(3) 8

(4) 9

Answer: (1)

Explanation:

We know that the number of fringe width is inversely proportional to wavelength of line used.

Thus, $n_1\lambda_1 = n_2\lambda_2$

Now, according to question,

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

$$n_2 = \frac{8 \times 600}{400}$$

$$n_2 = 12$$

Chapter Name: Wave Optics

32. The angle between the electric lines of force and the equipotential surface is:

(1) $180°$

(2) $0°$

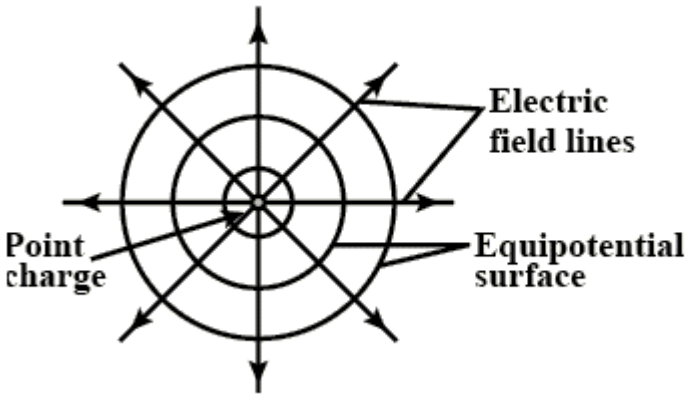
(3) $45°$

(4) $90°$

Answer: (4)

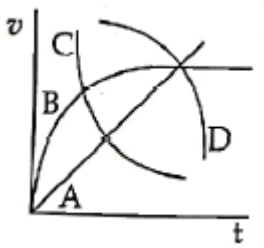
Explanation:

The angle between the electric field and the equipotential surface is always $90°$. The equipotential surface is always perpendicular to the electric field.



Chapter Name: Electric Charges and Fields

33. The 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) D
(2) A
(3) B
(4) C

Answer: (3)

Explanation:

Gravity first causes spherical ball to fall with increasing speed, but as it speeds up backward dragging force i.e., viscous force increases. Eventually the viscous force is enough to balance the force of gravity, so the acceleration stops, and the sphere reaches a constant terminal velocity.

Thus, graph B represent the required relation.

Chapter Name: Mechanical Properties of Fluids

34. 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) $9:4$
(2) $1:4$
(3) $4:1$
(4) $4:9$

Answer: (1)

Explanation:

The formula of energy in n^{th} orbit is,

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

$$T_1 = \frac{-13.6}{2^2}\ \text{eV}, T_2 = \frac{-13.6}{3^2}\ \text{eV}$$

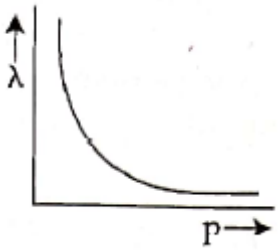
The ratio of both the energy level,

$$\frac{T_1}{T_2} = \frac{3^2}{2^2} = \frac{9}{4}$$

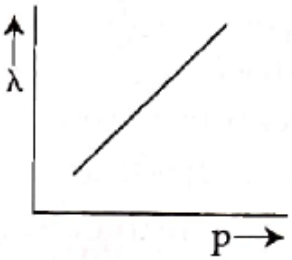
Chapter Name: Atoms

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

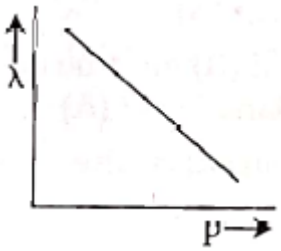
(1)



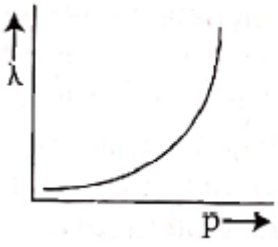
(2)



(3)



(4)



Answer: (1)

Explanation:

Using Relation $\lambda = \frac{h}{4\pi p} = \frac{h}{2p}$

$\lambda p = \frac{h}{2} =$ Constant

$\lambda p =$ Constant,

This is an equation of hyperbola.

Chapter Name: Dual Nature of Radiation and Matter

Section-B (Physics)

36. 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) 8

(2) 11

(3) 9

(4) 10

Answer: (2)

Explanation:

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

$\Rightarrow T \propto \sqrt{L}$

$\therefore \frac{T_1}{T_2} = \sqrt{\frac{L_1}{L_2}} = \sqrt{\frac{121}{100}} \Rightarrow \frac{T_1}{T_2} = \frac{11}{10}$

$\Rightarrow 10T_1 = 11T_2$

For shorter pendulum after 11 mean positions they meet again.

Chapter Name: Waves

37. The volume occupied by the molecules contained in $4.5\ \text{kg}$ water at STP, if the intermolecular forces vanish away is:

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

(2) $5.6\times10^{6}\ \text{m}^3$

(3) $5.6\times10^{3}\ \text{m}^3$

(4) $5.6\times10^{-3}\ \text{m}^3$

Answer: (1)

Explanation:

Using $PV = nRT \Rightarrow \quad V = \dfrac{nRT}{P}$

At S.T.P $T = 273\,K, \quad R = 8.314\,J.K^{-1}mol^{-1}, \quad P = 18\times10^{5}\,Pa$

$$V = \frac{\left(4.5\times10^{3}\right)\left(8.314\right)\left(273\right)}{18\times10^{5}}$$

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

Chapter Name: Kinetic Theory

38. 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) $25:16$

(2) $1:1$

(3) $4:5$

(4) $5:4$

Answer: (4)

Explanation:

$$R = R_0\left(A\right)^{\frac{1}{3}}$$

$$\therefore \frac{R_1}{R_2} = \left(\frac{125}{64}\right)^{\frac{1}{3}} = 5:4$$

Chapter Name: Nuclei

39. 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) **(A)** is false but **(R)** is true

(2) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**

(3) Both **(A)** and **(R)** are true and **(R)** is not the correct explanation of **(A)**

(4) **(A)** is true but **(R)** is false

Answer: (4)

Explanation:

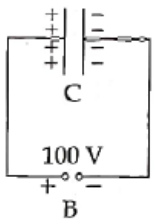
The stretching of coil simply changes its shape without any change in the length of the wire used in coil. Due to which shear modulus of elasticity is involved.

As we know that, $Y_{steel} > Y_{copper}$.

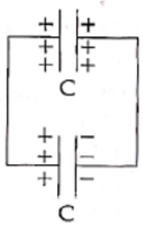
Chapter Name: Mechanical Properties of Solids

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

a).



b).



(1) $1.5\times10^{-6}\,\text{J}$

(2) $4.5\times10^{-6}\,\text{J}$

(3) $3.25\times10^{-6}\,\text{J}$

(4) $2.25\times10^{-6}\,\text{J}$

Answer: (4)

Explanation:

$Q_i = Q_f$

$Q = CV$

In final connection, both the capacitors are connected in parallel connection,

$C_{eq} = C + C = 2C$

$Q_i = 900\times10^{-12}\times100 = (C_1 + C_2)V_f \qquad (Q = CV)$

$\therefore V_f = \dfrac{900\times10^{12}\times100}{2\times900\times10^{12}} = 50\,V$

$E = \dfrac{1}{2}C_{eq}V_f^{\,2}$

$E = \dfrac{1}{2}\left(2\times900\times10^{-12}\right)50^2$

$E = 2.25\times10^{-6}\ \text{J}$

Chapter Name: Electrostatic Potential and Capacitance

41. From Ampere's circuital 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:

(1) a linearly decreasing function of distance upto the boundary of the wire and then a linearly increasing one for the outside region.

(2) uniform and remains constant for both the regions.

(3) a linearly increasing function of distance upto the boundary of the wire and then linearly decreasing for the outside region.

(4) a linearly increasing function of distance r upto the boundary of the wire and then decreasing one with $\dfrac{1}{r}$ dependence for the outside region.

Answer: (4)

Explanation:

From Ampere's circuital law, magnetic field inside the wire is,

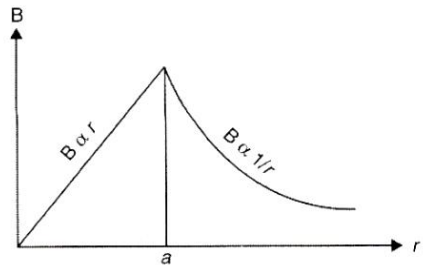
$$B = \frac{\mu_0 r I}{2\pi a^2}$$

$$B \propto r$$

The magnetic field outside the wire is,

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

Magnetic field increases to a maximum value at the surface of the wire and then decreases. The graph is shown below,



Chapter Name: Moving Charges and Magnetism

42. The area of a rectangular field (in m^2) of length $55.3\ \mathrm{m}$ and breadth $25\ \mathrm{m}$ after rounding off the value, for correct significant digits is:

(1) 14×10^2

(2) 138×10^1

(3) 1382

(4) 1382.5

Answer: (1)

Explanation:

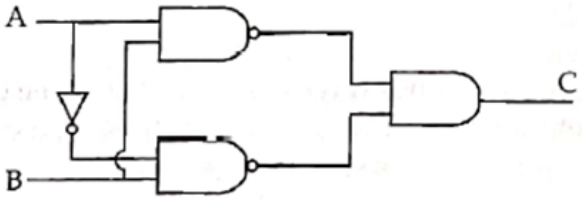
Area of Rectangles $A = l\times b = 55.3\times 2.5$

$$A = 1382.5$$

$$A = 13.825\times10^2$$

After Roundly off $= 14\times10^2$

Chapter Name: Units and Measurements

43. 

The truth table for the given logic circuit is:

(1)

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

(2)

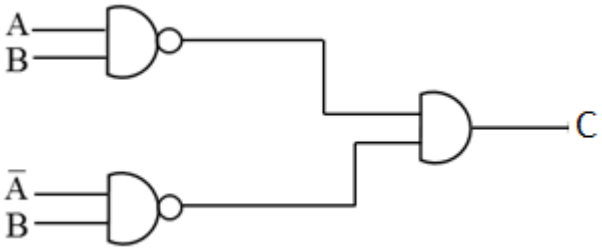
A	B	C
0	0	0
0	1	1
1	0	1
1	1	0

(3)

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

(4)

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



Answer: (4)

Explanation:

$C = \left(\overline{A \cdot B}\right) \cdot \left(\overline{\bar{A}B}\right)$

$= \left(\overline{A \cdot B}\right) \cdot \left(\overline{A} + \overline{B}\right)$

$= \left(\overline{A} + \overline{B}\right) \cdot \left(A + \overline{B}\right)$

$= \overline{A}A + \overline{A}\overline{B} + \overline{B}A + \overline{B}$

$= \overline{A}\overline{B} + \overline{B}\left(AP1\right)$

$= \overline{A}\overline{B} + \overline{B}$

$= \overline{B}\left(\overline{A} + 1\right)$

$C = \overline{B}$

Chapter Name: Semiconductor Electronics: Materials, Devices and Simple Circuits

44. Two transparent media A and B are separated by a plane boundary. The speed of light in those media are 1.5×10^8 m / s and 2.0×10^8 m/s, respectively. The critical angle for a ray of light for these two media is:

(1) $\tan^{-1}\left(0.750\right)$

(2) $\sin^{-1}\left(0.500\right)$

(3) $\sin^{-1}\left(0.750\right)$

(4) $\tan^{-1}\left(0.500\right)$

Answer: (3)

Explanation:

As we know for critical angle, Incidence angle ($i = 90^\circ$)

Using Snell's law,

$1.5 \times 10^8 \sin\left(90^\circ\right) = \left(2.0 \times 10^8 \sin\left(C\right)\right)$

$\frac{1.5 \times 10^8}{2.0 \times 10^8} = \sin\left(C\right)$

$\therefore$ Critical angle $C = \sin^{-1}\left(0.750\right)$

Chapter Name: Ray Optics and Optical Instruments

45. A big circular coil of 1000 turns and average radius $10\ \text{m}$ is rotating about its horizontal diameter at $2\ \text{rad}\ s^{-1}$. If the vertical component of earth's magnetic field at that place is $2\times10^{-5}\ \text{T}$ and electrical resistance of the coil is $12.56\ \Omega$, then the maximum induced current in the coil will be:

(1) $2\,A$

(2) $0.25\,A$

(3) $1.5\,A$

(4) $1\ \text{A}$

Answer: (4)

Explanation:

Using $\phi = n\vec{B}\cdot\vec{A} = nBA\cos\theta \qquad (\theta = \omega t)$

$$\phi = 1000\times(B)\times(\pi r^2)\cos(\omega t)$$

$$E = \left|\frac{d\phi}{dt}\right| = 1000\times B\times(\pi r^2)\,\omega\,(\sin\omega t)$$

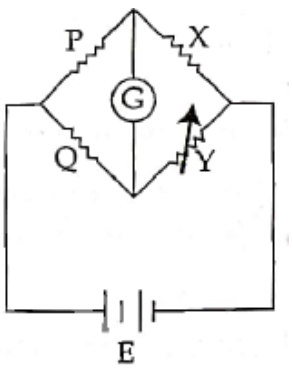
$$\varepsilon_{max} = (1000)(B)(\pi r^2)\,\omega$$

$$i_{max} = \varepsilon_{max}/R = 1000\times2\times10^{-5}\times(3.14)\times(10^2)\times\frac{2}{12.56}$$

$$i_{max} = 1\,\text{Amp}.$$

Chapter Name: Electromagnetic Induction

46. 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 resistances P and Q:



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

Answer: (3)

Explanation:

From Balanced Wheatstone bridge Circuit,

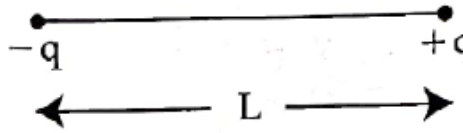
$$\frac{P}{Q} = \frac{X}{Y}$$

$$\Rightarrow X = \frac{PY}{Q}$$

For balance bridge circuit, if P and Q are equal and small then we will get $X = Y$.

Chapter Name: Current Electricity

47. 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 $R\,(R >> L)$ varies as:

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

Answer: (3)

Explanation:

Electric field due to an electric dipole at point on axial line,

$$\vec{E} = \frac{1}{4\pi\varepsilon_0}\left(\frac{2\vec{p}}{R^3}\right) \qquad (R >> L)$$

Electric field due to an electric dipole at a point on the equatorial plane,

$$\vec{E} = \frac{-1}{4\pi\varepsilon_0}\left(\frac{\vec{p}}{R^3}\right) \qquad (R >> L)$$

So, from above formula we can say that,

$$\vec{E} \propto \frac{1}{R^3}$$

Chapter Name: Electric Charges and Fields

48. Match List - I with List - II:

List-I		List – II	
a)	Gravitational constant (G)	(i)	$\left[L^2T^{-2}\right]$
b)	Gravitational potential energy	(ii)	$\left[M^{-1}L^3T^{-2}\right]$
c)	Gravitational potential	(iii)	$\left[LT^{-2}\right]$
d)	Gravitational intensity	(iv)	$\left[ML^2T^{-2}\right]$

Choose the correct answer from the options given below:

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

Answer: (3)

Explanation:

Gravitational constant $(G) = \left[M^{-1}L^3T^{-2}\right]$

Gravitational potential Energy $= \left[ML^2T^{-2}\right]$

[Analogies] Energy $E = \frac{1}{2}mv^2 = M\left(LT^{-1}\right)^2 = ML^2T^{-2}$

Gravitational potential $= \left[L^2T^{-2}\right]$

Gravitational inter $= \left[LT^{-2}\right]$

Chapter Name: Gravitation

49. A series LCR circuit with inductance $10\ H$, capacitance $10\ \mu F$, resistance $50\ \Omega$ 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) $v = 100\ \text{Hz}; v_0 = \frac{100}{\pi}\text{Hz}$

(2) $v_0 = v = 50\ \text{Hz}$

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

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

Answer: (3)

Explanation:

Resonance frequency $v_r = \frac{1}{2\pi\sqrt{LC}} = \frac{1}{2\pi\sqrt{10^{-4}}}$

$v_r = \frac{50}{\pi} Hz$

The equation of source voltage is,

$V = 200\sin(100t)$

From above,

$\omega = 100$

$\frac{2\pi}{T} = 100$

$2\pi v = 100$

$v = \frac{50}{\pi}$

Thus, $v = v_r = \frac{50}{\pi}\ \text{Hz}$

Chapter Name: Alternating Current

50. 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) $10\ ms^{-1}$

(2) Zero

(3) $5\sqrt{3}\ ms^{-1}$

(4) $5\ ms^{-1}$

Answer: (3)

Explanation:

At highest point of projectile, particle has only horizontal component of velocity because vertical component of velocity is zero.

$V_y = 0$

$V_x = V_0 \cos\theta$ [with vertical $\theta = 30°$]

$V_x = 10 \times \cos 30° = 10 \times \frac{\sqrt{3}}{2}$

$V_x = 5\sqrt{3}$

The speed of particle at the highest point of its trajectory is,

$u = \sqrt{(V_x)^2 + (V_y)^2}$

$u = \sqrt{\left(5\sqrt{3}\right)^2 + (0)^2}$

$u = 5\sqrt{3}\ m/s$

Chapter Name: Motion in a Plane

NEET Past Year Paper-2022

Section-A (Chemistry)

51. The pH of the solution containing $50\ \mathrm{mL}$ each of $0.10\ \mathrm{M}$ sodium acetate and $0.01\ \mathrm{M}$ acetic acid is

[Given pK_a, of $CH_3COOH = 4.57$]

(1) 2.57

(2) 5.57

(3) 3.57

(4) 4.57

Answer: (2)

Explanation:

Weak acid (CH_3COOH) and salt of weak acid-strong base (CH_3COONa) form an acidic buffer.

Sodium acetate $(CH_3COONa) = 0.10\ \mathrm{M}$;

Acetic acid $(CH_3COOH) = 0.01\ \mathrm{M}$;

pH of acidic buffer solution is given by

$$\mathrm{pH} = pK_a + \log \frac{[\mathrm{Salt}]}{[\mathrm{Acid}]}$$

$$= 4.57 + \log\left(\frac{0.1}{0.01}\right)$$

$$= 5.57$$

Chapter Name -: Electrochemistry

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

(1) $P_i = X_i p_i^o$, Where $x_i =$ mole fraction of i^{th} gas in gaseous mixture

P_i^o pressure of i^{th} gas in pure state

(2) $P = P_1 + P_2 + P_3$

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

(4) $P_i = x_i P$ where $p_i =$ partial pressure of i^{th} gas

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

Answer: (1)

Explanation:

Dalton's law of partial pressure :

Partial pressure of gas = mole fraction of gas in gaseous mixture × Total pressure of gaseous mixture.

$$p_1 = X_1 p$$

$$p_2 = X_2 p$$

$$p_3 = X_3 p$$

Total pressure,

$$p = p_1 + p_2 + p_3$$

Therefore, statement-3 is incorrect.

Chapter Name -: Solutions

53. The incorrect statement regarding enzymes is :
(1) Enzymes ate very specific for a particular reaction and substrate.
(2) Enzymes are biocatalysts.
(3) Like chemical catalysts enzymes reduce the activation energy of bio processes.
(4) Enzymes are polysaccharides.

Answer: (4)

Explanation:

Which is incorrect statement regarding enzymes

(1) Like chemical catalysts enzymes reduce the activation energy of bio process ⇒ This is correct statement.
(2) Enzymes are polysaccharides ⇒ This is incorrect statement because enzymes are protein in nature

(3) Enzymes are very specific for a particular reaction and substrate ⇒ This is correct statement.

(4) Enzymes are biocatalyst ⇒ This is correct statement.

Chapter Name -: Surface Chemistry

54. 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 reaction
(d)	Cs	(iv)	Photoelectric cell

Choose the correct answer from the options given below:

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

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

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

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

Answer: (1)

Explanation:

Li - Electrochemical cells

Na - Coolant in fast breeder reactors

KOH - absorbent for CO_2

Cs - Photoelectric cell.

Chapter Name -: Electrochemistry; Surface Chemistry

55. Given below are two statements :

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 statements, choose the most appropriate answer from the options given below :

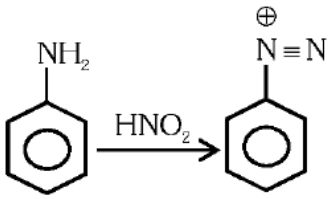
(1) Statement I is incorrect but Statement II is correct.
(2) Both Statement I and Statement II are correct.
(3) Both Statement I and Statement II are incorrect.
(4) Statement I is correct but Statement II is incorrect.

Answer: (4)

Explanation:

$$R-NH_2 \xrightarrow{HNO_2} R-N_2^{\oplus}$$

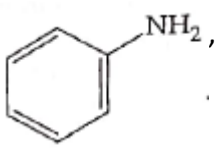
Alkyl diazonium ion (unstable)



Aryl diazonium ion stable at low temperature $(0-5°C)$

Chapter Name -: Nitrogen Containing Compounds

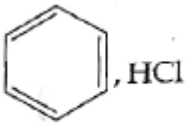
56. Which of the following is suitable to synthesize chlorobenzene?

(1) 

, HCl Heating

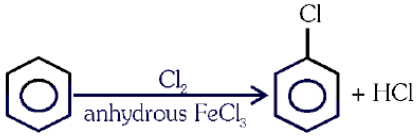
(2) Benzene, Cl_2, anhydrous $FeCl_3$

(3) Phenol, $NaNO_2, HCl, CuCl$

(4) 

Answer: (2)

Explanation:



Chapter Name -: Nitrogen Containing Compounds

57. Identify the incorrect statement from the following

(1) Lithium is the strongest reducing agent among the alkali metals.

(2) Alkali metals react with water to form their hydroxides.

(3) The oxidation number of K in KO_2 is $+4$.

(4) Ionisation enthalpy of alkali metals decreases from top to bottom in the group.

Answer: (3)

Explanation:

KO_2

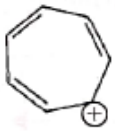
$K^+O_2^-$ (O_2^- - superoxide ion)

Chapter Name -: s-Block Elements

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

(1) 

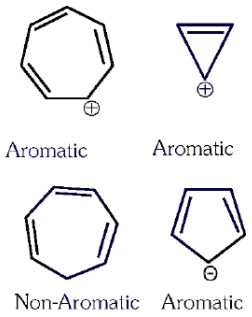
(2) 

(3) 

(4) 

Answer: (1)

Explanation:



Chapter Name -: Basic Concept of Organic Chemistry

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

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

(1) $2CuSO_4(aq) + 2Ag(s) \rightarrow 2Cu(s) + AgSO_4(aq)$

(2) $CuSO_4(aq) + Zn(s) \rightarrow ZnSO_4(aq) + Cu(s)$

(3) $CuSO_4(aq) + Fe(s) \rightarrow FeSO_4(aq) + Cu(s)$

(4) $FeSO_4(aq) + Zn(s) \rightarrow ZnSO_4(aq) + Fe(s)$

Answer: (1)

Explanation:

SRP : $E^\circ_{Zn^{2+}/Zn} < E^\circ_{Fe^{2+}/Fe} < E^\circ_{Cu^{2+}/Cu} < E^\circ_{Ag^{+}/Ag}$

Reactivity order : $Zn > Fe > Cu > Ag$

In case of displacement reaction, more reactive metals (lower SRP) can displace less reactive metals (higher SRP) from their salt solution.

$CuSO_{4(aq)} + 2Ag_{(s)} \rightarrow Cu_{(s)} + Ag_2SO_{4(aq)}$

Option (1)

Reaction is not possible

as Ag is less reactive metal compare to Cu .

Chapter Name -: d & f-Group Elements

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

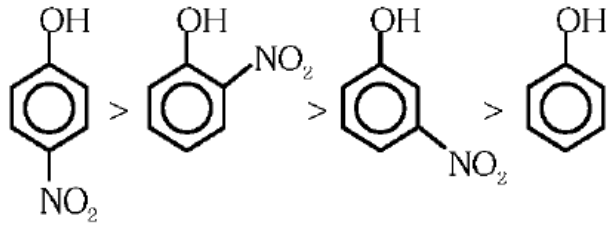
(1) Statement I is incorrect but Statement II is correct.
(2) Both Statement I and Statement IL are correct.
(3) Both Statement I and Statement II are incorrect.
(4) Statement I is correct but Statement II is incorrect.

Answer: (4)

Explanation:

Acidic strength of phenolic group increases due to electron withdrawing groups.

Order of acidic strength



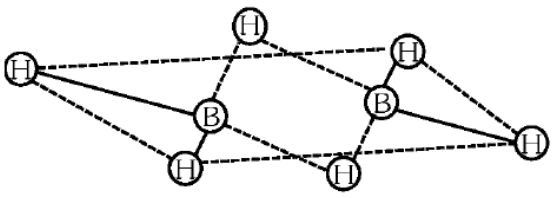
Chapter Name -: Alcohols, Phenols and Ethers

61. Which of the following statement is not correct about diborane?

(1) Both the Boron atoms are sp^2 hybridized
(2) There are two 3 - centre-2 -electron bonds.
(3) The four terminal $B-H$ bonds are two centre two electron bonds.
(4) The four terminal Hydrogen atoms and the two Boron atoms lie in one plane.

Answer: (1)

Explanation:



B has sp^3 Hybridisation

Non- planar

Chapter Name -: p-Block Elements

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

Answer: (3)

Explanation:

(i) Statement-1 is correct because in point defects of ionic solid electrical neutrality is essential condition (given question is example of metal deficiency defect)
(ii) Statement-2 is correct because In Frenkel defect cation dislocate from lattice site to interstitial position.
(iii) Both statement are correct but statement-2 is not correct explanation of statement-1

Chapter Name -: Solid States

63. Given below are two statements :

Statement 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.

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

Answer: (2)

Explanation:

Boiling point of comparable molecular mass molecules

$$\underset{\substack{\text{H-bonding}\\(\text{strong molecular association})}}{R-OH} > \underset{\substack{\text{Dipole-dipole interaction}\\(\text{weak molecular association})}}{\text{Aldehyde-Ketone}} > \underset{\text{Non-polar}}{\text{Alkane}}$$

Chapter Name -: Aldehydes, Ketones and Carboxylic Acids

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

Assertion (A) : ICl is more reactive than I_2.

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

Answer: (2)

Explanation:

Interhalogen compound group 17^{th}

ICl is more reactive due to polar bonds.

From NCERT - $X-X'$ bond is weaker than $X-X$ bond except F_2

Chapter Name -: p-Block Elements

65. Match List - I with List - II

List -I (Products formed)		List - II (Reaction of carbonyl compound with)	
(a)	Cyanohydrin	(i)	NH_2OH
(b)	Acetal	(ii)	RNH_2
(C)	Schiff's base	(iii)	alcohol
(D)	Oxime	(iv)	HCN

Choose the correct answer from the option given below:

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

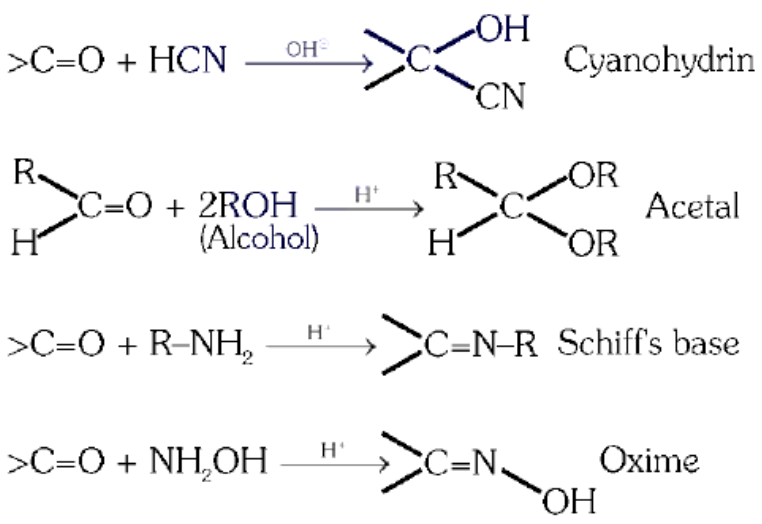
(2) (a)- (iii), (b) - (iv), (c) –(ii)- (d)(i)

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

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

Answer: (1)

Explanation:



Chapter Name -: Aldehydes, Ketones and Carboxylic Acids

66. Match List - I with List - II.

List -I (Hydrides)		List - II (Nature)	
(a)	MgH_2	(i)	Electron precise

(b)	GeH_4	(ii)	Electron deficient
(c)	B_2H_6	(iii)	Electron rich
(d)	HF	(iv)	Ionic

Choose the correct answer from the options given below:
(1) (a)- (ii), (b) - (iii), (c) –(iv)- (d)(i)
(2) (a)- (iv), (b) - (i), (c) –(ii)- (d)(iii)
(3) (a)- (iii), (b) – (i), (c) –(ii)- (d)(iv)
(4) (a)- (i), (b) – (ii), (c) –(iv)- (d)(iii)

Answer: (1)

Explanation:

Electron deficient hydride → Less than $8e^-$ (B_2H_6)

Electron precise hydride → having $8e^-$ without l.p. (GeH_4)

Electron rich hydride → having $8e^-$ with l.p. (HF)

Chapter Name -: Chemical Bondings

67. Gadolinium has a low value of third ionisation enthalpy because of
(1) high basic character
(2) small size
(3) high exchange enthalpy
(4) high electronegativity

Answer: (3)

Explanation:

$_{64}Gd = [Xe]6s^2 4f^7 5d^1$

$Gd^{+2} = [Xe]4f^7 5d^1$

After losing $5d$ electron $4f$ has maximum exchange energy so Gd has low value of Third Ionisation energy

Chapter Name -: d and f-Block Elements

68. Given below are two statements :

Statement I:

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

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

Statement II:

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

$NaCl > Na_2SO_4 > Na_3PO_4$

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

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

Answer: (4)

Explanation:

According to Hardy Schulze Rule statement 1 is correct. (Generally, the greater the valence of the flocculating ion added, the greater is its power to cause precipitation)

According to Hardy Schulze Rule statement 2 is incorrect

Chapter Name -: Surface Chemistry

69. 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 given below:
(1) (a)- (iv), (b) - (iii), (c) –(i)- (d)(ii)

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

Answer: (3)

Explanation:

Antacid - Cimetidine

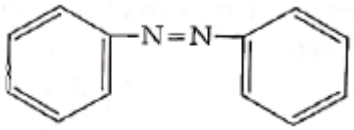
Antihistamine - Seldane

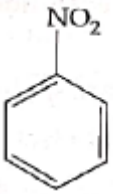
Analgesic - Morphine

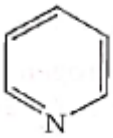
Antimicrobials – Salvarsan

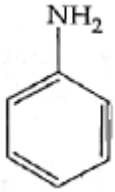
Chapter Name -: Chemistry in Everyday Life

70. 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?

(1) 

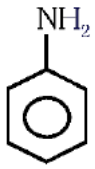
(2) 

(3) 

(4) 

Answer: (4)

Explanation:



Kjeldahl's method is not applicable to the compounds containing nitrogen having nitro and azo group and nitrogen present in the ring (pyridine), as nitrogen of these compounds does not change to ammonium sulphate under these conditions.

Chapter Name -: Basic Concept of Organic Chemistry

71. Choose the correct statement :
    (1) Both diamond and graphite are used as dry lubricants.
    (2) Diamond and graphite have two dimensional network,
    (3) Diamond is covalent and graphite is ionic.
    (4) Diamond is sp^3 hybridised and graphite is sp^2 hybridized.

    Answer: (4)

    Explanation:

    In diamond each carbon is bonded with four other carbon atoms. So hybridisation of carbon atom is sp^3.

    In graphite each carbon is bonded with three other carbon atoms. So hybridisation of carbon atom is sp^2.

    Chapter Name -: p- Block Elements

72. The IUPAC name of the complex -

    $\left[Ag(H_2O_2)\right]\left[Ag(CN)_2\right]$ is:

    (1) diaquasilver(I) dicyanidoargentate(I)
    (2) dicyanidosilver(II) diaquaargentate(II)
    (3) diaquasilver(II) dicyanidoargentate(II)
    (4) dicyanidosilver(I) diaquaargentate(I)

    Answer: (1)

    Explanation:

    IUPAC

$\left[Ag\left(H_2O \right)_2 \right]$ $\left[Ag\left(CN \right)_2 \right]$

Coordination number $= 2$

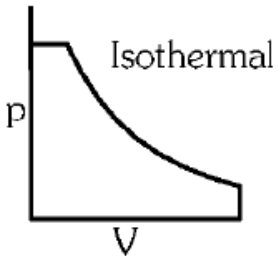
Oxidation state $= Ag^{+1}$

Diaquasilver (I) dicyanidoargentate (I)

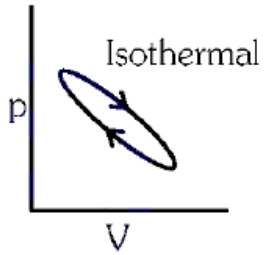
Chapter Name -: Coordination Compounds

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

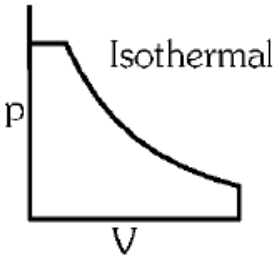
(1)



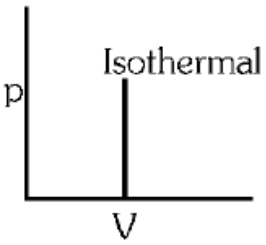
(2)



(3)



(4)



Answer: (3)

Explanation:

In $P-V$ graph area under the curve represent magnitude of work.

As it is maximum in graph-1

So correct answer is (3)

Chapter Name -: Thermodyanamics

74. In one molal solution that contains 0.5 mole of a solute, there is
(1) $1000\ \mathrm{g}$ of solvent
(2) $500\ \mathrm{mL}$ of solvent
(3) $500\ \mathrm{g}$ of solvent
(4) $100\ \mathrm{mL}$ of solvent

Answer: (3)

Explanation:

$$\mathrm{m} = \frac{\mathrm{Moles\ of\ solute}}{\mathrm{Weight\ of\ solvent\ (g)}} \times 1000$$

$$\mathrm{l} = \frac{0.5}{\mathrm{Weight\ of\ solvent\ (g)}} \times 1000$$

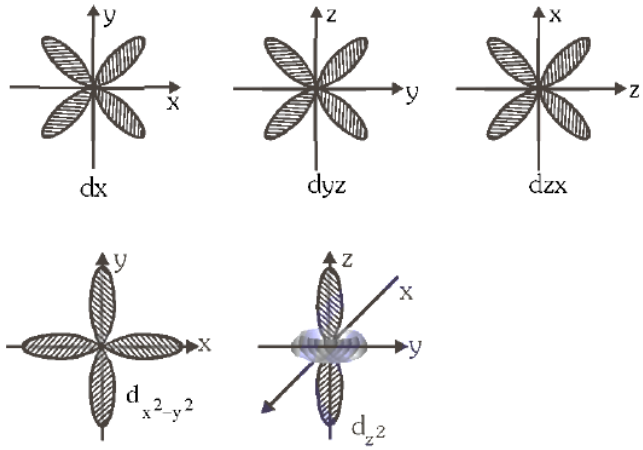
Weight of solvent $(\mathrm{g}) = 500\ \mathrm{g}$

Chapter Name -: Basic Concepts of Chemistry

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

Answer: (1)

Explanation:



Chapter Name -: Structure of Atoms

76. What mass of 95% pure $CaCO3$, will be required to neutralise $50\ mL$ of $0.5\ M$ HCl solution according to the following reaction ?

$$CaCO_{3(s)} + 2HCl_{(aq)} \rightarrow CaCl_{2(aq)} + CO_{2(g)} + 2H_2O_{(1)}$$

[Calculate upto second place of decimal point]

(1) $9.50\ g$

(2) $1.25\ g$

(3) $1.32\ g$

(4) $3.65\ g$

Answer: (1)

Explanation:

$$CaCO_{3(s)} + 2HCl_{(aq)} \rightarrow CaCl_{2(aq)} + CO_{2(g)} + 2H_2O_{(1)}$$

no. of moles of $CaCO_3$ (pure) $= \frac{1}{2} \times$ mole of HCl

[Mole $=$ molarity $\times$ volume(in ltr.)]

$$= \frac{1}{2} \times 0.5 \times \frac{50}{1000} = 0.0125$$

weight of $CaCO_3$ (pure) $=$ mole $\times$ mol. wt

$$= 0.0125 \times 100 = 1.25\ g$$

$$\%\ \text{purity} \frac{\text{wt. of pure substance}}{\text{wt. of impure sample}} \times 100$$

$$95 = \frac{1.25}{\text{wt. of impure sample}} \times 100$$

$$\text{wt. of impure sample} = \frac{1.25 \times 100}{95} = 1.32\ \text{g}$$

Chapter Name -: Basic Concepts of Chemistry

77. Which amongst the following is incorrect statement?

(1) O_2^+ ion is diamagnetic.

(2) The bond orders of O_2^+, O_2, O_2^- and O_2^{2-} are $2.5, 2, 1.5$ and 1, respectively.

(3) C_2 molecule has four electrons in its two degenerate π molecular orbitals.

(4) H_2^+ ion has one electron.

Answer: (1)

Explanation:

O_2^+ ion is having 15 electrons, so it contain one unpaired electron. Hence it is paramagnetic in nature.

Chapter Name -: Chemical Bonding

78. $RMgX + CO_2 \xrightarrow[\text{ether}]{\text{dry}} Y \xrightarrow{H_3O^+} RCOOH$ What is Y in the above reaction?

(1) $(RCOO)_2 Mg$

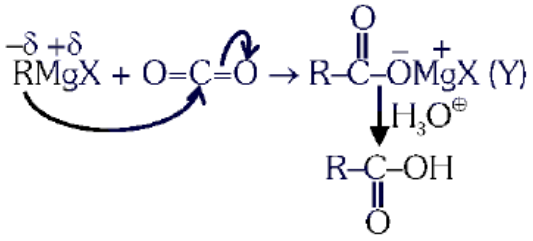
(2) $RCOO^- Mg^+ X$

(3) $R_3CO^- Mg^+ X$

(4) $RCOO^- X^+$

Answer: (2)

Explanation:



Chapter Name -: Aldehydes, Ketones and Carboxylic Acid

79. Given below are half cell reactions :

$$MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$$

$$E^\circ_{Mn^{2+}/MnO_4^-} = -1.510V$$

$$\frac{1}{2}O_2 + 2H^+ + 2e^- \rightarrow H_2O$$

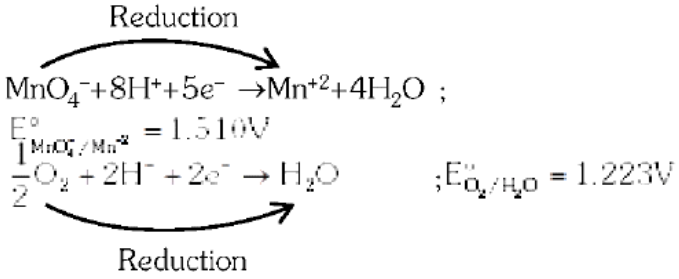
$$E^\circ_{O_2/H_2O} = +1.223V$$

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

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

Answer: (3)

Explanation:



Cathode:

$$2MnO_4^- + 16H^+ + 10e^- \rightarrow 2Mn^{+2} + 8H_2O;$$

$$E^\circ_{RP} = 1.510V$$

Anode:

$$5H_2O \rightarrow \frac{5}{2}O_2 + 10H^+ + 10e^-$$

$$E^\circ_{OP} = -1.223V$$

Target reaction:

$$2MnO_4^- + 6H^+ \rightarrow 2Mn^{+2} + \frac{5}{2}O_2 + 3H_2O;$$

$$E^\circ_{cell} = (SRP)_{Cathode} - (SRP)_{Anode}$$

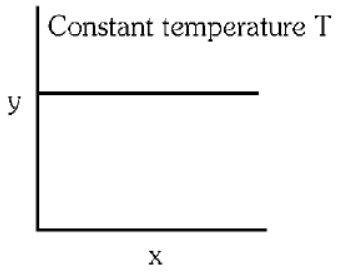
$$E^\circ_{cell} = 1.510V - 1.223V$$

$$= 0.287V$$

Yes the given cell reaction is possible.

Chapter Name -: Electrochemistry

80. 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 ($y =$ rate and $x =$ concentration), first order ($y =$ rate and $x = t_{\frac{1}{2}}$)

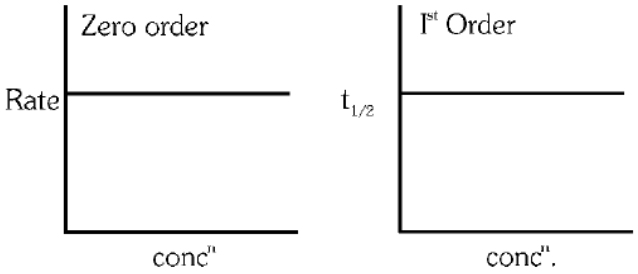
(2) zero order ($y =$ concentration and $x =$ time), first order ($y = t_{\frac{1}{2}}$ and $x =$ concentration)

(3) zero order ($y =$ concentration and $x =$ time), first order ($y =$ rate constant and $x =$ concentration)

(4) zero order ($y =$ rate and $x =$ concentration), first order ($y = t_{\frac{1}{2}}$ and $x =$ concenration)

Answer: (4)

Explanation:



I. curve is suitable for zero order if $y =$ rate and $x =$ concentration because in case of zero order reaction rate is constant and does not depend on conc".

II. curve is suitable for first order if $y = t_{\frac{1}{2}}$ and $x =$ conc" because in case of first order $t_{\frac{1}{2}}$ does not depend on conc".

Chapter Name -: Chemical Kinetics

81. The incorrect statement regarding chirality is :
(1) A racemic mixture shows zero optical rotation.
(2) S_N1 reaction yields $1:1$ mixture of both enantiomers,
(3) The product obtained by S_N2 reaction of haloalkane having chirality at the reactive site shows inversion of configuration.
(4) Enantiomers are superimposable mirror images on each other.

Answer: (4)

Explanation:

Enantiomers are non-superimposable mirror images of each other.

Chapter Name -: Alkyl Halides and Aryl Halides

82. The IUPAC name of an element with atomic number 119 is
(1) ununoctium
(2) ununennium
(3) unnilennium
(4) unununnium

Answer: (2)

Explanation:

IUPAC nomenclature

$119 \rightarrow$ Ununennium $\rightarrow$ Uue

Chapter Name -: Classification of Periodic Table

83. Which statement regarding polymers is not correct ?
(1) Thermosetting polymers are reusable.
(2) Elastomers have polymer chains held together by weak intermolecular forces,
(3) Fibers possess high tensile strength.
(4) Thermoplastic polymers are capable of repeatedly softening and hardening on heating and cooling respectively.

Answer: (1)

Explanation:

Thermosetting polymers are NOT reusable.

Chapter Name -: Polymers

84. Given below are two statements:

Statement I:

The boiling points of the following hydrides of group 16 elements increases in the order -

$H_2O < H_2S < H_2Se < H_2Te$

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:

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

Answer: (3)

Explanation:

Hydrides of group 16^{th}

$\underset{H-bond}{H_2O}\ \ \underset{VWA\propto mol.wt}{H_2S < H_2Se < H_2Te}$

$B.P. \rightarrow H_2S < H_2Se < H_2Te < H_2O$

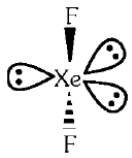
Chapter Name -: p-Block Elements

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

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

Answer: (1)

Explanation:



XeF_2 has maximum 3 lone-pair - lone-pair repulsions

Chapter Name -: p-Block Elements

Section-B (Chemistry)

86. For a first order reaction $A \rightarrow$ Products, initial concentration of A is $0.1\,\mathrm{M}$, which becomes $0.001\,\mathrm{M}$ after 5 minutes. Rate constant for the reaction in min^{-1} is

(1) 0.2303
(2) 1.3818
(3) 0.9212
(4) 0.4606

Answer: (3)

Explanation:

$A \rightarrow$ Products

Initial conc. $A_t = 0.1\,\mathrm{M}$

Conc. After $5\,\mathrm{min}$ $A_t = 0.001\,\mathrm{M}$

$t = 5\,\mathrm{min}.$

For first order reaction

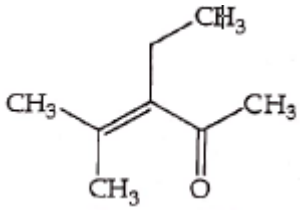
$$K = \frac{2.303}{t}\log\left|\frac{A_o}{A_t}\right|$$

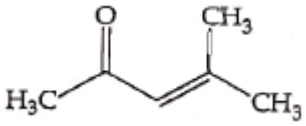
$$= \frac{2.303}{5}\log\left|\frac{0.1}{0.001}\right|$$

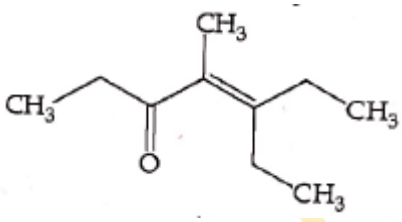
$$K = 0.9212\,\mathrm{min}^{-1}$$

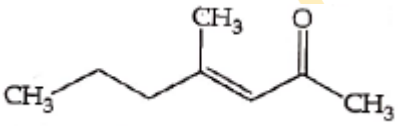
Chapter Name -: Chemical Kinetics

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

(1) 

(2) 

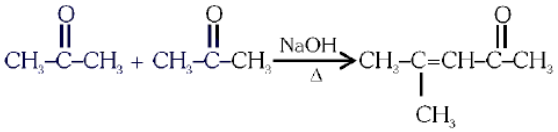
(3) 

(4) 

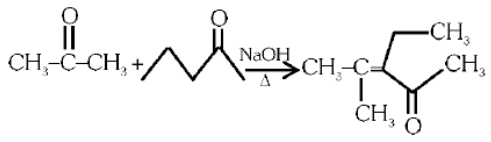
Answer: (3)

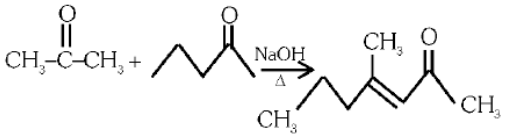
Explanation:

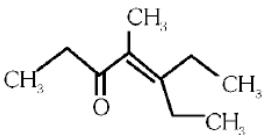
Self aldol



Cross Aldol







will not form

Chapter Name -: Aldehyde, Ketones and Carboxylic Acids

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

(1) $+6$ to $+5$

(2) $+7$ to $+4$

(3) $+6$ to $+4$

(4) $+7$ to $+3$

Answer: (2)

Explanation:

$$\underset{\downarrow}{KMnO_4} + I^- \xrightarrow[\text{or weak alkaline medium}]{\text{Neutral}} \underset{\downarrow}{MnO_2} + IO_3^-$$
$$\quad +7 \qquad\qquad\qquad\qquad\qquad\qquad\quad +4$$

Change $+7$ to $+4$

Chapter Name -: d and f – Block Elements

89. Compound X on reaction with O_3 followed by Zn/H_2O gives formaldehyde and 2 -methyl propanal as products. The compound X is :

(1) Pent-2 -ene

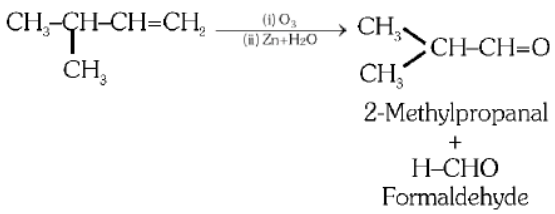
(2) 3 -Methylbut-1 -ene

(3) 2 -Methylbut-1 -ene

(4) 2 -Methylbut-2 -ene

Answer: (2)

Explanation:



Chapter Name -: Hydrocarbons

90. $3O_2(g)\ f \quad 2O_3(g)$

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) 1.2×10^{21}

(2) 4.38×10^{-32}

(3) 1.9×10^{-63}

(4) 2.4×10^{31}

Answer: (2)

Explanation:

$3O_2(g)\ f \quad 2O_3(g)$

$$K_c = \frac{[O_3]^2}{[O_2]^3}$$

$$3\times10^{-59} = \frac{[O_3]^2}{\left(4\times10^{-2}\right)^3}$$

$$[O_3]^2 = 3\times10^{-59}\times64\times10^{-6}$$

$$= 19.2\times10^{-64}$$

$$= 4.38\times10^{-32}\,\mathrm{M}$$

Chapter Name -: Chemical Equilibrium

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

(1) 158.7 Å

(2) 158.7 pm

(3) $15.87\mathrm{pm}$

(4) 1.587 pm

Answer: (2)

Explanation:

Acc. to Bohr's atomic model

$r \propto \frac{n^2}{z}$ 3^{rd} orbit of Li^{+2} $n_1 = 3$

$$Z_1 = 3$$

$\Rightarrow$ 2^{nd} orbit of He^{+} $n_2 = 2$

$$Z_2 = 2$$

$$\frac{(r_3)_{Li^{+2}}}{(r_2)He^{+}} = \frac{n_1^2}{n_2^2} \times \frac{Z_2}{Z_1}$$

$$\frac{(r_3)_{Li^{+2}}}{105.8\,pm} = \frac{3 \times 3}{2 \times 2} \times \frac{2}{3}$$

$$(r_3)_{Li^{+2}} = 158.7\,pm$$

Chapter Name -: Solid States

92. 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), (c), (d) only
(2) (a), (d) only
(3) (a), (b), (d) only
(4) (b), (c), (d) only

Answer: (3)

Explanation:

The presence of particulate matter in polluted air catalyses the oxidation of sulphurdioxide to sulphur trioxide.

$$2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$$

The reaction can also be promoted by ozone and hydrogen peroxide.

$$SO_2(g) + O_3(g) \rightarrow SO_3(g) + O_2(g)$$

$$SO_2(g) + H_2O_2(l) \rightarrow H_2SO_4(aq)$$

Chapter Name -: Environmental Chemistry

93. A $10.0\,\text{L}$ flask contains $64\,\text{g}$ of oxygen at $27°\text{C}$. (Assume O_2 gas is behaving ideally).

The pressure inside the flask in bar is

(Given $R = 0.0831\,\text{L bar } K^{-1}\,\text{mol}^{-1}$)

(1) 4.9
(2) 2.5
(3) 498.6
(4) 49.8

Answer: (1)

Explanation:

$V = 10\,\text{L} \quad W_{O_2} = 64\,\text{g}$

$T = 27°\text{C} \quad n_{O_2} = 2$

$R = 0.083.\text{L bar } K^{-1}\text{mol}^{-1}$

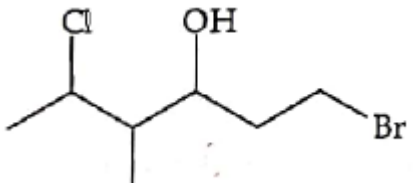
Ideal gas equation $PV = nRT$

$$P = \frac{2 \times 0.0831 \times 300}{10}$$

$P = 4.9\,\text{bar}$

Chapter Name -: States of Matter

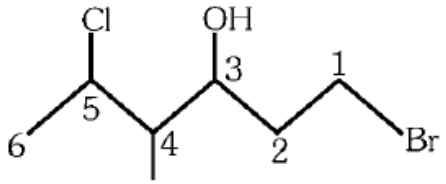
94. The correct IUPAC name of the following compound is:



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

Answer: (2)

Explanation:



1 -bromo-5 -chloro-4 -methylhexan-3 -ol

Chapter Name -: Hydrocarbons

95. Given below are two statements :

Statement I:

In Lucas test, primary, secondary and tertiary alcohols are distinguished on the basis of their reactivity with conc. $HCl + ZnCl_2$ known as Lucas Reagent.

Statement 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 :

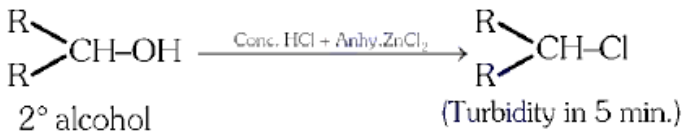
(1) Statement I is incorrect but Statement II is correct.
(2) Both Statement I and Statement II are correct.
(3) Both Statement I and Statement II are incorrect.
(4) Statement I is correct but Statement II is incorrect.

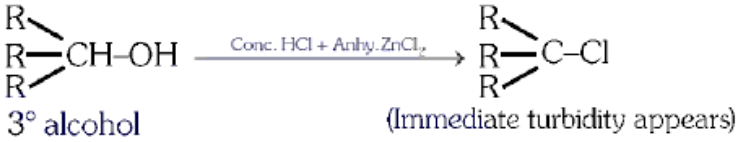
Answer: (4)

Explanation:

$1°, 2°, 3°$ Alcohol are distinguished by Lucas test on the basis of the time taken for turbidity to appear

$$\underset{1° \text{alcohol}}{R - CH_2 - OH} \xrightarrow{\text{Conc.}HCl + \text{Anhy.}ZnCl_2} \underset{(\text{Turbidity in 30 min.})}{R - CH_2 - Cl}$$





Reactivity of alcohol towards Lucas reagent

$\Rightarrow 3° > 2° > 1°$ Alcohol

Chapter Name -: Alcohol, Phenols and Ethers

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

(A) $\left[Ni(H_2O)_2(en)_2\right]^{2+}$

(B) $\left[Ni(H_2O)_4(en)\right]^{2+}$ and

(C) $\left[Ni(en)_3\right]^{2+}$

is

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

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

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

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

Answer: (4)

Explanation:

(A) $\left[Ni(H_2O)_2(en)_2\right]^{2+}$

(B) $\left[Ni(H_2O)_4(en)\right]^{2+}$

(C) $\left[Ni(en)_3\right]^{2+}$

en is SFL (strong field ligand)

As the number of en (strong ligand) increase splitting also increases.

So, Δ_0 increases.

i.e. maximum energy will be absorbed in case of option C.

So the order is $C > A > B$

Chapter Name -: Coordination Chemistry

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

(1) $65\,u$

(2) $63.1\,u$

(3) $31.55\,u$

(4) $60\,u$

Answer: (2)

Explanation:

$$d = \frac{Z + M}{N_A \times a^3}$$

$$8.92 = \frac{4 \times M}{6.022 \times 10^{23} \times \left(3.608 \times 10^{-8}\right)^3}$$

$$M = \frac{8.92 \times 6.022 \times 10^{23}}{4} \times 46.96 \times 10^{24}$$

$M = 63.1 \text{g/mol}$ (Molar Atomic Mass)

$M = 63.1u$ (Atomic Mass)

Chapter Name -: Solid States

98. Find the emf of the cell in which the following reaction takes place at $298\ K$

$$Ni(s) + 2Ag^+(0.001M) \rightarrow Ni^{2+}(0.001M) + 2Ag(s)$$

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

(1) $1.05V$

(2) $1.0385V$

(3) $1.385\ V$

(4) $0.9615\ V$

Answer: (Bonus)

Explanation:

$$Ni(s) + 2Ag^{+}(0.001M) \rightarrow Ni^{+2}(0.001M) + 2Ag(s)$$

$$E_{cell} + E^{\circ}_{cell} - \frac{0.059}{n}\log\frac{\left[Ni^{+2}\right]^{1}}{\left[Ag^{+}\right]^{2}}$$

$$E_{cell} = 10.5 - \frac{0.059}{2}\log\frac{10^{-3}}{\left(10^{-3}\right)^{2}}$$

$$= 10.5 - \frac{0.059}{2}\log 10^{+3}$$

$$= 10.5 - \frac{0.059}{2} \times 3$$

$$= 10.4115V$$

Chapter Name -: Electrochemistry

99. Match List - I with List - II.

List-I (Ores)		**List - II (Composition)**	
(a)	Haematite	(i)	Fe_3O_4
(b)	Magnetite	(ii)	$ZnCO_3$
(c)	Calamine	(iii)	Fe_2O_3
(d)	Kaolinite	(iv)	$\left[Al_2(OH)_4 Si2_5O_5\right]$

Choose the correct answer from the options given below:

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

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

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

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

Answer: (3)

Explanation:

Haematite Fe_2O_3

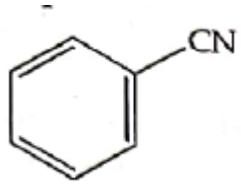
Magnetite Fe_3O_4

Calamine $ZnCO_3$

Kaolinite $\left[Al_2(OH)_4 Si_2O_5\right]$

Chapter Name -: General Principles and Process of Isolation of Elements

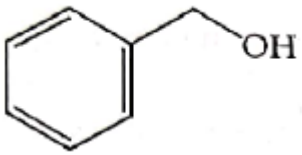
100. The product formed from the following reaction sequence is

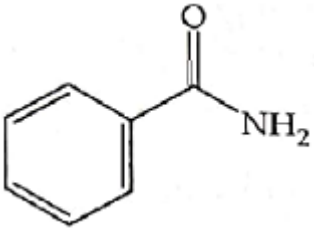


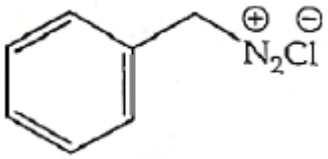
$(i)\ LiAlH_4, H_2O$

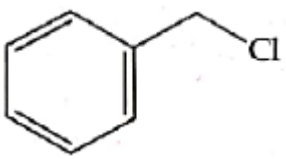
$(ii)\ NaNO_2 + HCl$

$(iii)\ H_2O$

(1) 

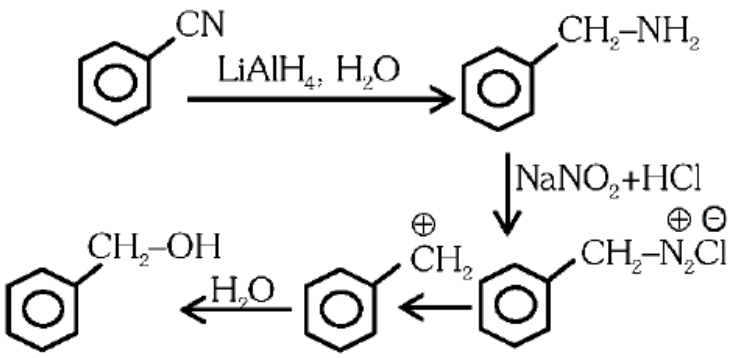
(2) 

(3) 

(4) 

Answer: (1)

Explanation:



Chapter Name -: Nitrogen Containing Compounds

NEET Past Year Paper-2022

Section-A (Biology)

101. Which one of the following never occurs during mitotic cell division?
(1) Coiling and condensation of the chromatids
(2) Spindle fibres attach to kinetochores of chromosomes
(3) Movement of centrioles towards opposite poles
(4) Pairing of homologous chromosomes

Answer (4)

Explanation:

Steps in Mitosis

- In the first phase, prophase occurs, a centriole, located outside the nucleus, divides. The long, **threadlike material of the nucleus coils up into visible chromosomes**, and the nuclear membrane disappears. From the centrioles, long, thin strands extend in all directions. Many of these from one centriole join with strands from the other to form the spindle.
- The second phase of mitosis is metaphase, in which the **chromosomes move into the equatorial plane of the spindle**.
  In the third phase, anaphase begins, the chromatids separate and move to opposite ends of the cell. Once the chromatids separate, they are now called as chromosomes. Thus a complete set **of chromosomes migrates toward each centriole.**
- In the last phase telophase occurs, the cell divides. The changes then taking place are the reverse of those that occurred during prophase: **the chromosomes uncoil, new membranes form around the nuclei, and the fibers of the spindle disappear**. The cell has divided, and the two identical cells then are ready to begin their first period of growth.
- In Meiosis, at the end of prometaphase I, meiotic cells enter metaphase I. Here, in sharp contrast to mitosis, **pairs of homologous chromosomes line up opposite each other on the metaphase plate, with the kinetochores on sister chromatids facing the same pole.**

  Thus Pairing of homologous chromosomes never occurs during mitotic cell division but during meiosis.

Chapter Name -: Cell Cycle and Cell Division

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

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

Answer (4)

Explanation:

Predation (+/–) : A free living organism which catches and kills another species for food. Predation is a type of interaction which is very important. It ensures that there is stability in the ecosystem. The two main populations interacting in predation are the predators and the prey. Without the predators, the prey population will go out of control. The species diversity in a community is also maintained by the predators. Predator reduce the amount of the competition between prey species. The prey species have also evolved several mechanisms to lessen the impact of predation. In Predation, one (Predator) is benefitted symbolized by a "+" sign and the other (prey) is at loss symbolized by a "–" sign

E.g.,

Insectivores fungi : Dactylella, Arthrobotrys, Dactylaria,

Carnivores animals : Lion, snake

Insectivores plants : Drosera, Nepenthes, Utricularia

Chapter Name -: Organism and Population

103. Which one of the following plants does **not** show plasticity?

(1) Maize
(2) Cotton
(3) Coriander
(4) Buttercup

Answer (1)

Explanation:

The developmental process seen in plants is not mostly straight, some plants follow different pathways and produce different structures. This ability of plants to follow different pathways and produce different structures in response to their environment is known as plasticity. The example of plasticity is heterophylly.

Heterophylly is the phenomenon of appearance of different forms of leaves on the same plant. Some examples are Larkspur, cotton and coriander, in which the leaves of the juvenile plants are different in shape in comparison to the mature plant. In contrast, in buttercup plant different shapes of leaves are observed present in air and water which depicts that the plant shows heterophylly with change in its habitat. Maize plant does not show heterophylly or any form of plasticity in itself.

Juvenile Maize plant

Mature Maize plant

Chapter Name -: Plant Growth and Development

104. The flowers are Zygomorphic in:

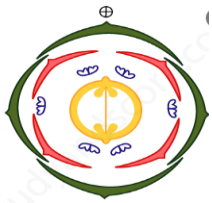
(a) Mustard
(b) Gulmohar
(c) *Cassia*
(d) *Datura*
(e) Chilly

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

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

Answer (3)

Explanation:

Plant Name	Family	Floral Diagram	Floral Formula
Mustard	**Brassicaceae**		Ebr $\oplus \sigma K_{2+2}\, C_{\times 4}\, A_{2+4}\, \underline{G_{(2)}}$
Gulmohar, *Cassia*	**Fabaceae**		% ♂ K (5) C1+ (2) +2 A (9) + 1 $\underline{G_1}$
Chilly, *Datura*	**Solanaceae**		Br ⊕ ☿ $K_{(5)}$ $\overset{\frown}{C_{(5)}}$ A_5 $\underline{G_{(2)}}$.

Family -Flower Characters

Brassicaceae- Flowers are Actinomorphic and Zygomorphic

Fabaceae - Flowers are Zygomorphic

Solanaceae- Flowers are Actinomorphic

The flowers are Zygomorphic in family Fabaceae and the example from the options are Gulmohar and *Cassia.*

Chapter Name -: Morphology of Flowering Plants

105. Which one of the following is not true regarding the release of energy during ATP synthesis through chemiosmosis? It involves:
(1) Reduction of NADP to NADPH2 on the stroma side of the membrane
(2) Breakdown of proton gradient
(3) Breakdown of electron gradient
(4) Movement of protons across the membrane to the stroma

Answer (3)

Explanation:

- Mitchell has been put forward Chemiosmotic hypothesis in 1961 to explain the mechanism of ATP synthesis.
- When electrons are transported through the electron transport system (ETS), the protons accumulate inside the thylakoid membranes.
- Lumen of thylakoid fills with H^+ ion due to photolytic splitting of water.
- Primary acceptor of electron is located on the outer side of the thylakoid membrane which transfers its electron to an H-carrier.
- The carrier removes a proton from the matrix while transporting electrons to the inner side of the membrane. The proton is released into the lumen while the electron passes to next carrier.
- NADP reductase is situated on the outer side of the thylakoid membrane. **It obtains electrons from PSI and protons from matrix to reduce $NADP^+$ to NADP + H^+ state.**
- **The gradient is broken down due to the movement of protons across the membrane to the stroma through the transmembrane channel of the F_0 of the ATPase.**
- ATPase enzyme has two parts – F_0 and F_1 particles.
- one is F_0 embedded in the membrane and forms a transmembrane channel that carries out facilitated diffusion of protons across the membrane
- **Other portion is called F_1 and protrudes on the outer surface of the thylakoid membrane on the side that faces the stroma**.
- **The break down of the gradient provides enough energy to cause a conformational change in the F_1 particle of the ATPase, which makes the enzyme synthesise several molecules of energy-packed ATP.**
- The transient F_1 particle of ATPase enzyme form ATP from ADP and inorganic phosphate.
- Chemiosmosis requires a membrane, a proton pump, a proton gradient and ATPase.
- One molecule of ATP is formed when $2H^+$ ions pass through ATPase
- Thus, in chemiosmosis the breakdown of proton gradient happens and not breakdown of electron gradient during the release of energy during ATP synthesis .

Chapter Name -: Photosynthesis in Higher Plants

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

Answer (3)

Explanation:

The highly sensitive PCR method enables quick DNA amplification of a particular section. Using visual methods based on size and charge, PCR may detect and identify gene sequences by producing billions of copies of a certain DNA fragment or gene.

The vector also needs a selectable marker in addition to "ori". Typically, selectable markers for *E. coli* are believed to be genes that encode resistance to antibiotics like ampicillin, chloramphenicol, tetracycline, or kanamycin, among others.

Cloning vectors and Polymerase chain reaction are two different process and they are not dependent on each other.

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

Chapter Name -: Biotechnology and its Applications

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

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

Answer (4)

Explanation:

Biodiversity is the occurrence of different types of ecosystem, different species of organisms with their biotypes and genes adapted to different climates, environments along with their interaction and processes.

Habitat Loss and Fragmentation- Expanding population and development require more industrial area, extension of present towns and cities, more area for agriculture, new roads, canals, dams etc. All these activities will result in the destruction of natural habitat or habitat loss. Destruction of habitat is the primary cause of extinction of species. Habitat fragmentation is the breaking of a large habitat into smaller patches due to the development of agriculture, water body and other changes.

Over-Exploitation -Over exploitation of any particular species reduces the size of its population so that it becomes vulnerable to extinctions, e.g., hunting of animals, collection of medicinal plants.

Alien Species Invasions - Any new species entering in a geographical region are known as exotic or alien species. It may cause disappearance of native species through changed biotic interaction, like - Nile perch, where a large predator fish was introduced in Lake Victoria of South Africa. It begins to threaten the entire freshwater ecosystem by feeding on small herbivorous and carnivorous cichlid fish species which were endemic to the aquatic system.

Co-Extinctions - When a species becomes extinct, the plant and animal species associated with it also become extinct. Example, in a coevolved plant-pollinator mutualism, extinction of one always leads to the extinction of the other.

Thus Habitat loss and fragmentation, over exploitation, alien species invasion and co-extinction are causes for Biodiversity loss and not Natality, Population explosion or Competition

Chapter Name -: Biodiversity and Conservation

108. Given below are two statements:

Statement I:

The primary CO_2 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, choose the correct answer from the options given below:

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

Answer (2).

Explanation:

The 3-carbon compound phosphoenolpyruvate (PEP) serves as the initial CO2 acceptor in the C4 cycle and is found in the mesophyll cells. PEP carboxylase, also known as PEPcase, is the enzyme that catalyses this CO2 fixation. The enzyme RuBisCO is absent from the mesophyll cells of C4 plants. The mesophyll cells are where the 4-carbon oxaloacetic acid (OAA) is created. In the mesophyll cells themselves, it is then changed into various 4-carbon compounds like malic acid or aspartic acid, which are then transferred to the bundle sheath cells. These C4 acids are degraded in the bundle sheath cells, producing CO2 and a 3-carbon compound. The C3 pathway receives the CO2 that was emitted in the bundle sheath cells. Transport of the 3-carbon molecule back to the mesophyll cells occurs. Thus, Both Statement I and Statement II are correct

Chapter Name -: Photosynthesis in Higher Plants

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

Answer (1)

Explanation:

Option 2- Pollination by water is quite rare in flowering plants as it takes place by insects, birds, bat or wind often.

Option 3- Pollination by wind is more common amongst abiotic pollination as compared to water. Option 4 - Some plants emit this unpleasant odour in place of special fragrance to attract flies and beetles, which often lay their eggs in rotting matter and pollinate plants with flies and beetles. The insects visit the blooms because they are attracted by the aroma and unintentionally pollinate them before they go.

Option 1 - Most flowering plants rely on a variety of animals to pollinate them. Common pollinators include bees, butterflies, flies, beetles, wasps, ants, moths, birds (sunbirds and hummingbirds), and bats. The primary biotic pollinators among animals are insects, especially bees. Thus option 2,3 and 4 are correct and option 1 is incorrect.

Chapter Name -: Sexual Reproduction in Flowering Plants

110. Hydrocolloid carrageen is obtained from:
(1) Phaeophyceae only
(2) Chlorophyceae and Phaeophyceae
(3) Phaeophyceae and Rhodophyceae
(4) Rhodophyceae only

Answer (4)

Explanation:

Based on their colour or pigments, algae can be categorized into three subgroups. Red algae or Rhodophyceaehas the dominance of the red pigment phycoerythrin, members of the Rhodophyceae family are frequently referred to as red algae. Red algae's cell wall is well recognised for containing specific mucopolysaccharides, such as agar and carrageenan. An illustration of red algae is gelidium. It is a significant source of agar, a substance used to harden bacterial cultures. A polysaccharide called carrageenan is extracted from the cell walls of Chondrus crispus (Irish moss). The stabilisation of emulsions in paints, cosmetics, and the sugar and alcohol industries all employ it. Carrageenan is also known as Irish moss and is abundantly found in Ireland. The thallus of this algae is finely and profusely branched. The red alga Chondrus crispus is typically discovered close to the Northern Atlantic coast.

Chapter Name -: Plant Kingdom

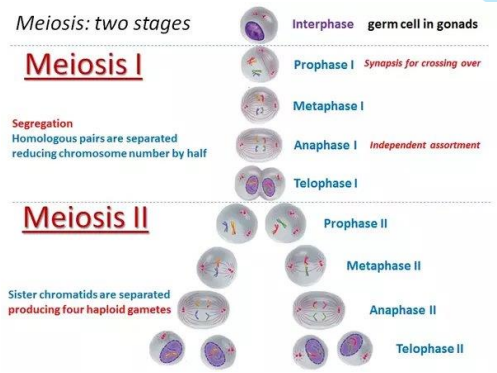
111. The appearance of recombination nodules on homologous chromosomes during meiosis characterizes:
(1) Terminalization
(2) Synaptonemal complex
(3) Bivalent
(4) Sites at which crossing over occurs

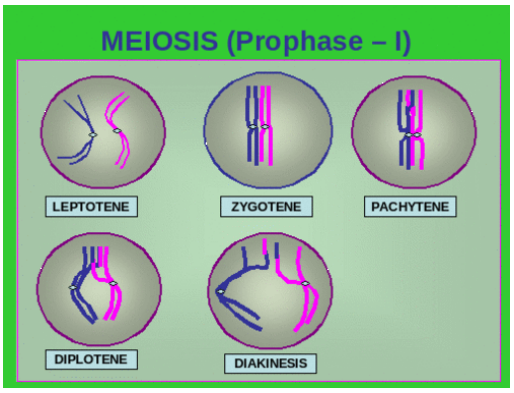
Answer (4)

Explanation:

There are two divisions in meiosis; the first division is meiosis I: the number of cells in which are doubled but the number of chromosomes is not. This results in 1/2 as many chromosomes per cell. The second division is meiosis II: this division is similar to mitosis; the number of chromosomes does not get reduced. It results in the formation of two haploid cells from one diploid cell. The daughter cells are, therefore, haploid but with 2n DNA content. It is divided into four phases i.e., prophase, metaphase, anaphase, telophase. Further, there are five stages in prophase 1 (lepotene, zygotene, pachytene, diplotene and diakinesis)

During Pachytene, in the tetrad, two similar chromatids of the same chromosome are called sister chromatids while chromatids belonging to different chromosomes of the homologous pairs are termed as non-sister chromatids. Crossing over i.e., exchange of segments between non-sister chromatids of homologous chromosomes occurs at this stage. It takes place by breakage and reunion of chromatid segments. Breakage called nicking is assisted by an enzyme endonuclease and reunion termed annealing is done by an enzyme ligase. A tetrad consists of two sets of homologous chromosomes each with two chromatids. Chromatids of pachytene chromosomes are attached with centromere. Each tetrad has four kinetochores (two sisters and two homologous). A number of electron dense bodies about 100 nm in diameter are seen at irregular intervals within the centre of the synaptonemal complex known as recombination nodules. These are believed to be sites having multienzyme recombinase complex required for crossing over.





Chapter Name -: Cell Cycle and Cell Division

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

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

Answer (4)

Explanation:

Gel electrophoresis is a technique used to separate DNA fragments according to their size. DNA samples are loaded into wells (indentations) at one end of a gel, and an electric current is applied to pull them through the gel. The charge on DNA fragments is negative charge, so they move towards the positive electrode. Because all DNA fragments have the same amount of charge per mass, small fragments move through the gel faster than large ones. When a gel is stained with a DNA-binding dye, the DNA fragments can be seen as bands, each representing a group of same-sized DNA fragments. The separated DNA fragments can be visualised only after staining the DNA with a compound known as ethidium bromide followed by exposure to UV radiation. We can see bright orange coloured bands of DNA in a ethidium bromide stained gel exposed to UV light. The separated bands of DNA are cut out from the agarose gel and extracted from the gel piece. This step is known as elution. The DNA fragments purified in this way are used in constructing recombinant DNA by joining them with cloning vectors. Thus, presence of chromogenic substrate never gives blue coloured DNA bands on the gel.

Chapter Name -: Biotechnology – Principles and Processes

113. The gaseous plant growth regulator is used in plants to:

(1) kill dicotyledonous weeds in the fields
(2) speed up the malting process
(3) promote root growth and root hair formation to increase the absorption surface
(4) help overcome apical dominance

Answer (3)

Explanation:

2, 4-D is widely used as a herbicide to kill dicotyledonous weeds. Gibberellins are used to speed up the malting process in brewing industry. Ethylene gas promotes

root growth and root hair formation, it also helps the plants to increase their absorption surface Presence of cytokinin in an area causes preferential movement of nutrients towards it. When applied to lateral buds, they help in their growth even though apical bud is present. They thus act antagonistically to auxin which promotes apical dominance. Therefore cytokinin can overcome apical dominance, caused by auxins.

Chapter Name -: Plant Growth and Development

114. Read the following statements about the 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) (a), (c), (d) and (e) Only
(2) (a), (b) and (d) Only
(3) (b), (c), (d) and (e) Only
(4) (a), (b), (c) and (d) Only

Answer (NA) No option is correct

Explanation:

In roots, xylem and phloem in a vascular bundle are arranged in an alternate manner along the different radii. Conjoint closed vascular bundles do not possess cambium. In open vascular bundles, cambium is present in between xylem and phloem. The vascular bundles of dicotyledonous stem possess endarch protoxylem. In monocotyledonous root, usually there are more than six xylem bundles present. All the statements are correct regarding vascular bundles but none of the options with such combination is given

Chapter Name -: Anatomy of Flowering Plants

115. Which of the following is **incorrectly** matched?

(1) *Volvox* – Starch
(2) *Ectocarpus* – Fucoxanthin

(3) *Ulothrix* – Mannitol
(4) *Porphyra* – Floridian Starch

Answer (3)

Explanation:

Volvox belongs to class Chlorophyceae which have reserve food in the form of starch. Their cell wall is made up of cellulose. *Ectocarpus* is an example of class Phaeophyceae and food is stored as complex carbohydrates, in the form of laminarin or mannitol. *Porphyra* belongs to class Rhodophyceae which have a cell wall composed of cellulose, pectin, and sulfated phycocolloids. They have reserved food as floridean starch. *Ulothrix* is an example of class Chlorophyceae and Mannitol is a characteristic feature of class Phaeophyceae. Thus option 3 is incorrectly matched.

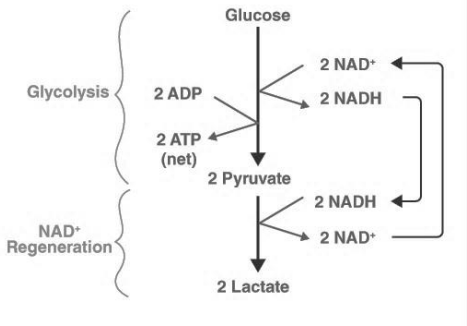
Chapter Name -: Plant Kingdom

116. What amount of energy is released from glucose during lactic acid fermentation?
(1) Less than 7%
(2) Approximately 15%
(3) More than 18%
(4) About 10%

Answer (1)

Explanation:

In fermentation, say by yeast, the incomplete oxidation of glucose is achieved under anaerobic conditions by sets of reactions where pyruvic acid is converted to CO2 and ethanol. The enzymes, pyruvic acid decarboxylase and alcohol dehydrogenase catalyse these reactions. Other organisms like some bacteria produce lactic acid from pyruvic acid. The steps involved are shown in Figure 14.2. In animal cells also, like muscles during exercise, when oxygen is inadequate for cellular respiration pyruvic acid is reduced to lactic acid by lactate dehydrogenase. The reducing agent is NADH+H+ which is reoxidised to NAD+ in both the processes. In both lactic acid and alcohol fermentation not much energy is released; less than seven per cent of the energy in glucose is released and not all of it is trapped as high energy bonds of ATP. Also, the processes are hazardous – either acid or alcohol is produced.



Chapter Name -: Respiration in Plants

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

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

Answer (4)

Explanation:

In Humans and other primates eg Monkey, the males have autosomes plus XY, while female have autosomes plus XX. In Drosophila the males have one X and one Y chromosome, whereas females have a pair of X-chromosomes besides autosomes. In Birds, females have one Z and one W chromosome, whereas males have a pair of Z-chromosomes besides the autosomes. Grasshopper is an example of XO type of sex determination in which the males have only one X-chromosome besides the autosomes, whereas females have a pair of X-chromosomes.

Chapter Name -: Principles of Inheritance and Variation

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

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

Answer (4)

Explanation:

In the process of glycolysis, the glucose molecule which is a 6 carbon compound splits into 2 molecules of 3-phosphoglyceraldehyde, 3-phosphoglyceraldehyde is a three carbon compound. During the process, two molecules of NADH, two molecules of ATP are produced from the metabolism of a molecules of pyruvic acid. Thus from 2 molecules of pyruvic acid forms four molecules of pyruvate and four molecules of ATP. Though during glycolysis, total 4 ATPs are produced from one glucose molecule but two are already used in the cycle thus with a net gain of only 2 ATPs.

Chapter Name -: Respiration in Plants

119. Match List-I with List-II

List-I		**List-II**	
(a)	Manganese	(i)	Activates the enzyme catalase
(b)	Magnesium	(ii)	Required for pollen germination
(c)	Boron	(iii)	Activates enzymes of respiration
(d)	Iron	(iv)	Functions in splitting of water during photosynthesis

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

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

Answer (3)

Explanation:

Manganese: It is absorbed in the form of manganous ions (Mn^{2+}). It activates many enzymes involved in photosynthesis, respiration and nitrogen metabolism. The best defined function of manganese is in the splitting of water to liberate oxygen during photosynthesis.

Magnesium: It is absorbed by plants in the form of divalent Mg^{2+}. It activates the enzymes of respiration, photosynthesis and are involved in the synthesis of DNA and RNA. Magnesium is a constituent of the ring structure of chlorophyll and helps to maintain the ribosome structure.

Boron: It is absorbed as BO_3^{3-} or $B_4O_7^{2-}$. Boron is required for uptake and utilisation of Ca^{2+}, membrane functioning, pollen germination, cell elongation, cell differentiation and carbohydrate translocation.

Iron: Plants obtain iron in the form of ferric ions (Fe3+). It is required in larger amounts in comparison to other micronutrients. It is an important constituent of proteins involved in the transfer of electrons like ferredoxin and cytochromes. It is reversibly oxidised from Fe2+ to Fe3+ during electron transfer. It activates catalase enzyme and is essential for the formation of chlorophyll.

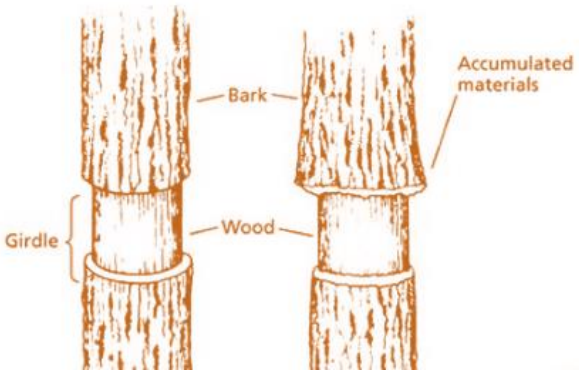
Chapter Name -: Mineral Nutrition

120. "Girdling Experiment" was performed by Plant Physiologists to identify the plant tissue through which:
(1) osmosis is observed
(2) water is transported
(3) food is transported
(4) for both water and food transportation

Answer (3)

Explanation:

The Girdling experiment is used to determine the tissue through which food is carried. In this experiment, girdling, a process that removes a ring of bark (phloem) from the wood, is used. Water and nutrients reach the leaves because the inner side's woody xylem section is still in tact. However, since the phloem component is eliminated after photosynthesis, food is not transferred to other areas below the girdle. Therefore, it is noted that food and sugar have accumulated immediately above the girdle area. The phloem tissue helps carry food, as demonstrated by this experiment. Thus, girdling experiment shows that phloem is the tissue responsible for translocation of food; and that transport takes place in one direction i.e. towards the root.



Chapter Name -: Transport in Plants

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

(1) Cryopreservation
(2) *In vitro* fertilization
(3) National Parks
(4) Micropropagation

Answer (3)

Explanation:

In-situ conservation of biodiversity is takes place within the natural habitat of the species. This method allows for the protection of natural ecosystem in which the species live in. The In situ conservation includes the development of: National Parks, Wildlife Sanctuaries and Biosphere Reserves

Ex-situ conservation means breeding and maintenance of endangered species in artificial ecosystems. These are man-made ecosystems like zoos, nurseries, botanical gardens, gene banks and others. In such an arrangement there is little or no competition for food, water and space between animal species. in-vitro fertilisation, cryopreservation, and micropropagation are examples of ex-situ conservation.

Chapter Name -: Biodiversity and Conservation

122. Given below are two statements:

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

Answer (4)

Explanation:

Decomposition is the process in which decomposers breakdown complex organic matter into inorganic substances. The rate of decomposition is controlled by chemical composition of detritus and climatic factors. Decomposition is slower if

detritus is rich in lignin and chitin and faster, if detritus is rich in nitrogen and water soluble substances eg; sugars.

Chapter Name -: Ecosystem

123. 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:

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

Answer (3)

Explanation:

Heterochromatin is transcriptionally inactive. A typical nucleosome contains 200 bp of DNA helix. Euchromatin is the loosely packed chromatin region. The negatively charged DNA is wrapped around the positively charged histone octamer to form a structure called nucleosome. Histones are rich in basic amino acid residues lysine and arginine.

Chapter Name -: Molecular Basis of Inheritance

124. 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 pumpkin
(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), (b), (d) and (e) Only
(2) (b) and (c) Only
(3) (a) and (d) Only
(4) (b), (c), (d) and (e) Only

Answer (4)

Explanation:

The stem may not always be typically like what they are expected to be. They are modified to perform different functions. Axillary buds of stems may also get modified into woody, straight and pointed thorns. Thorns are found in many plants such as Citrus, Bougainvillea. They protect plants from browsing animals.

Stem tendrils which develop from axillary buds, are slender and spirally coiled and help plants to climb such as in gourds (cucumber, pumpkins, watermelon) and grapevines.

Some plants of arid regions modify their stems into flattened (Opuntia), or fleshy cylindrical (Euphorbia) structures.

In some plants such as Rhizophora growing in swampy areas, many roots come out of the ground and grow vertically upwards. Such roots, called pneumatophores, help to get oxygen for respiration

Underground stems of some plants such as grass and strawberry, etc., spread to new niches and when older parts die new plants are formed.

Chapter Name -: Morphology of Flowering Plants

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

Answer (3)

Explanation:

The nitrogen-fixing microbes could be free-living or symbiotic. Examples of free-living nitrogen-fixing aerobic microbes are Azotobacter and Beijerinckia while Rhodospirillum is anaerobic and free-living. In addition, a number of cyanobacteria such as Anabaena and Nostoc are also freeliving nitrogen-fixers. Several types of

symbiotic biological nitrogen fixing associations are known. The most prominent among them is the legume-bacteria relationship. Species of rod-shaped Rhizobium has such relationship with the roots of several legumes such as alfalfa, sweet clover, sweet pea, lentils, garden pea, broad bean, clover beans, etc. The most common association on roots is as nodules. These nodules are small outgrowths on the roots. The microbe, Frankia, also produces nitrogen-fixing nodules on the roots of non-leguminous plants (e.g., Alnus). Both Rhizobium and Frankia are free living in soil, but as symbionts, can fix atmospheric nitrogen.

Chapter Name -: Mineral Nutrition

126. Which one of the following plants shows vexillary aestivation and diadelphous stamens?

(1) Solanum nigrum
(2) Colchicum autumnale
(3) Pisum sativum
(4) Allium cepa

Answer: (3)

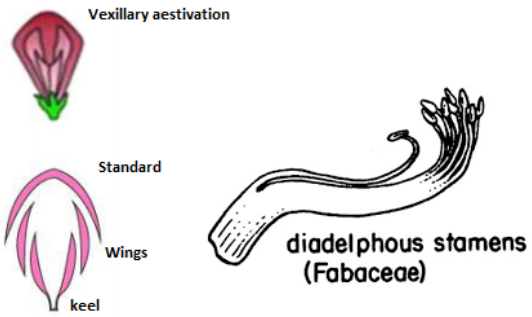
Explanation:

Descending imbricate or Vexillary aestivation: The posterior petal overlapping the two lateral petals, the lateral overlapping the two anterior petals. It is also called papilionaceous corolla. The stamens are fused by their filaments only. Fusion of filaments may produce a single group (monoadelphous) or two group (diadelphous) stamens. Diadelphous are the characteristic features of family Fabaceae.

Pisum sativum belongs to family Fabaceae.

Allium cepa and Colchicum autumnale (colchicine) belong to family Liliaceae.

Solanum nigrum belongs to Solanaceae.



Chapter Name: Morphology of Flowering Plants

127. 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 options given below:

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

Answer: (1)

Explanation:

Cleistogamy means closed marriage, and it describes a self-pollinating flower whose petals remain sealed shut. Cleistogamous flowers does not open at all. In such flowers, anthers and stigma lie close to each other. When the anthers dehisce in the flower buds, pollen grains come in contact with the stigma and pollination occurs. Lack of cross pollination is a disadvantage of cleistogamy.

Viola plant (a). Chasmogamous flowers (above ground)
(b). Cleistogamous flowers (underground)
(c). Seed pod (underground) formed after autogamy

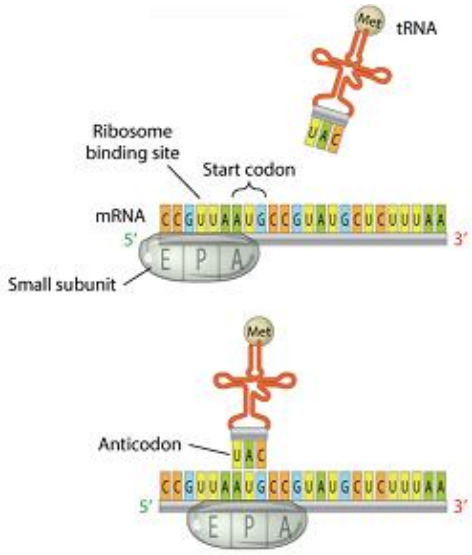
Chapter Name: Morphology of Flowering Plants

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

Answer: (4)

Explanation:

When the small subunit of ribosome encounters an mRNA, the process of translation of the mRNA to protein begins. The translation of mRNA begins with the formation of a complex on the mRNA. First, three initiation factor proteins (known as IF1, IF2, and IF3) bind to the small subunit of the ribosome. This process is followed by the binding of bigger/larger subunit. t-RNA is activated by the addition of amino acid prior to the attachment of ribosome, in the first phase.



Chapter name: Molecular Basis of Inheritance

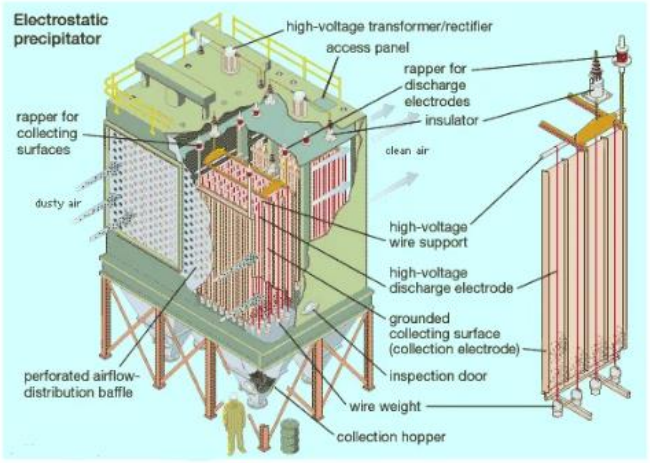
129. The device which can remove particulate matter present in the exhaust from a thermal power plant is:
(1) Catalytic Convertor
(2) STP
(3) Incinerator
(4) Electrostatic Precipitator

Answer: (4)

Explanation:

Electrostatic precipitator can remove over 99% particulate matter present in the exhaust from an industrial and thermal power plant. An electrostatic precipitator (ESP) for controlling the emissions of particulate matter (PM) from small-scale heating units, specifically boilers that combust solid fuel with a heating power output

of <300 kW. **Catalytic converters** are fitted into automobiles for reducing emission of poisonous gases. **STPs** are associated with sewage treatment.



Chapter Name: Environmental Issues

130. Exoskeleton of arthropods is composed of:

(1) Glucosamine
(2) Cutin
(3) Cellulose
(4) Chitin

Answer: (4)

Explanation:

The chitin contains the protein molecule and the deposits of calcium carbonate are mainly by the process of bio mineralization. Exoskeleton is the outer most covering which is found in most of the insects. Its main function is to provide a hard covering and to protect the insects from the environmental factors. **Chitin** forms the exoskeleton in arthropods and is found in fungal cell wall. **N-acetyl glucosamine** is the monomeric unit. **Cellulose** is a polysaccharide. **Cutin** is a derived lipid.

Chapter name: Animal Kingdom

131. DNA polymorphism forms the basis of:
(1) Translation
(2) Genetic mapping
(3) DNA finger printing
(4) Both genetic mapping and DNA finger printing

Answer: (4)

Explanation:

Allelic sequence variation has been described as a DNA polymorphism if its frequency is greater than 0.01. Simply, if an inheritable mutation is observed in a population at high frequency, it is referred to as DNA polymorphism.

DNA fingerprinting is a technique of determining nucleotide sequences of certain areas of DNA which are unique to each individual. Although the DNA from different individuals is more alike than different, there are many regions of the human chromosomes that exhibit a great deal of diversity. Such variable sequences are termed "polymorphic". A special type of polymorphism, called VNTR (variable number of tandem repeats), is composed of repeated copies of a DNA sequence that lie adjacent to one another on the chromosome. Since polymorphism is the basis of genetic mapping of human genome, therefore it forms the basis of DNA fingerprinting too.

Chapter Name: Molecular Basis of Inheritance

132. 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.

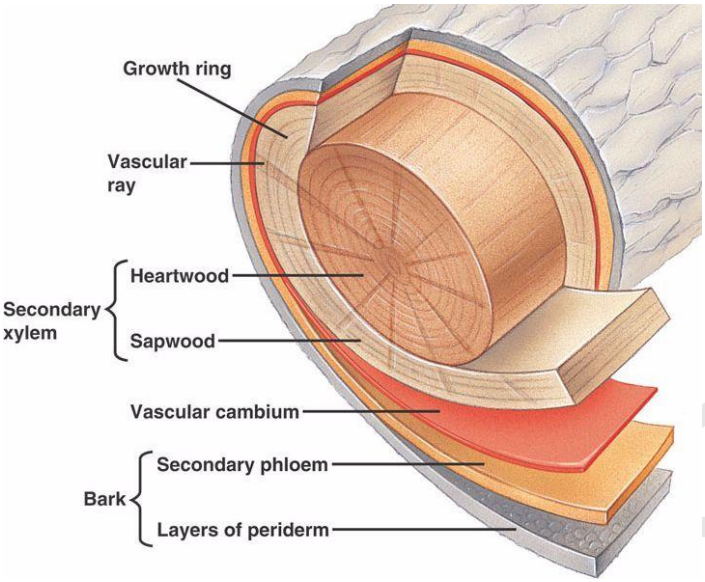
Choose the correct answer from the options given below:

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

Answer: (2)

Explanation:

In woody trees, the central portion of stem is dark in colour. It is bard and tough due to deposition of resins, tannins, gums and formation of tyloses. This central hard portion is called heart wood. It is formed by secondary growth. Due to cambial activity, secondary xylem becomes non-functional and forms heart wood or duramen. It is more durable and little susceptible to attack of pathogens. The cambial activity continues in this region.



Chapter Name: Anatomy of Flowering Plants

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

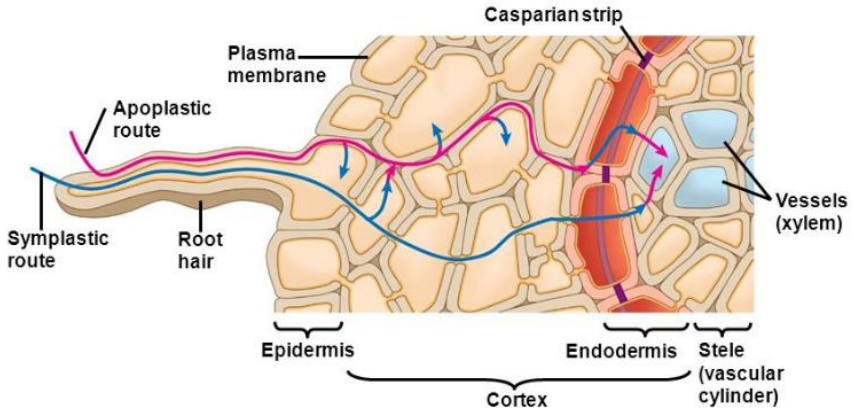
(1) Apoplast is continuous and does not provide any barrier to water movement
(2) Movement of water occurs through intercellular spaces and wall of the cells
(3) The movement does not involve crossing of cell membrane
(4) The movement is aided by cytoplasmic streaming

Answer: (4)

Explanation:

Water taken up by the root hairs is a result of diffusion and water is regulated by unique water channels called “Aquaporins”. The main plant vasculature assisting in water distribution to the entire plant is xylem and water is not directly accessible to xylem, therefore before xylem water travels via all the root parts by the means of different pathways; symplastic and apoplastic. The symplastic system is system of interconnected protoplasts. Symplastic movement is aided by cytoplasmic

streaming. Neighbouring cells are connected through cytoplasmic strands that extend through plasmodesmata. The water travels through cell cytoplasm and plasmodesmata, hence the movement is relatively slower.



Chapter Name: Transport in Plants

134. 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 options given below:

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

Answer: (2)

Explanation:

Gregor J. Mendel, conducted hybridisation experiments on garden peas and selected 14 true breeding pea plant varieties, as pairs which were similar except for one character with contrasting traits. It means, Mendel selected 7 characters in pea plant for carrying out hybridization experiments. Contrasting traits studied were smooth or wrinkled seeds, yellow or green seeds, inflated on constricted pods, green or yellow pods, tall or dwarf plants, violet or white flowers and axial or terminal flower positions.

	Flower Colour	Plant Height	Seed Color	Seed Shape	Pod Colour	Pod Shape	Flower Position
Dominant Trait	 Purple	 Tall	 Yellow	 Round	 Green	 Inflated (full)	 Axial
Recessive Trait	 White	 Short	 Green	 Wrinkled	 Yellow	 Constricted (flat)	 Terminal

Chapter Name: Principles of Inheritance and Variation

135. 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) Cytokinin
(2) ABA
(3) Gibberellin
(4) Ethylene

Answer: (4)

Explanation:

Ethylene is a simple gaseous plant hormone. It promotes Femaleness (Feminsing effect) in Pineapple (Bromeliaceae) and Cucumber. Ethylene increases the number of female flowers and fruits in certain plants such as cucumber. Gibberellins are used to increase the size of fruits in some plants.

Chapter Name: Growth and Development

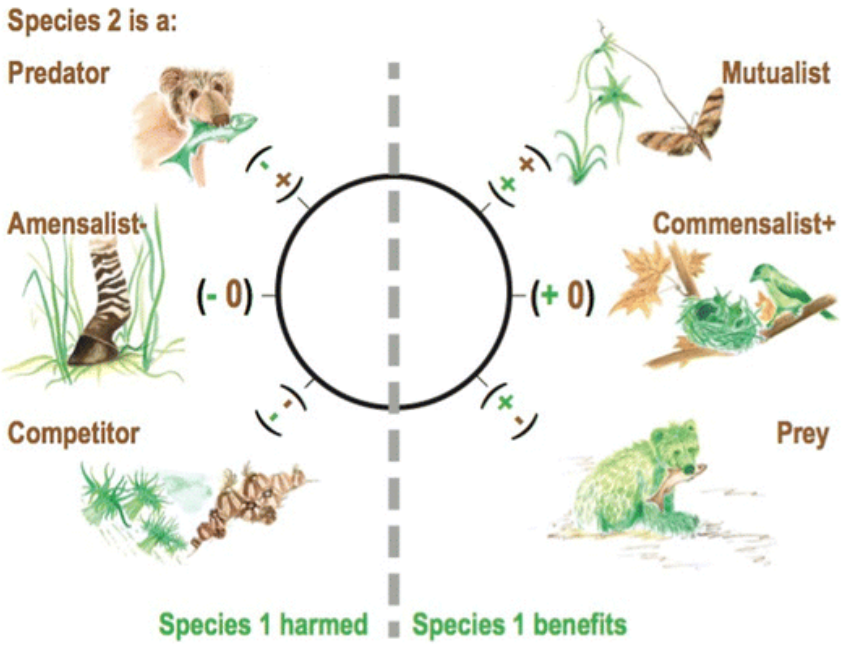
136. While explaining interspecific interaction of population, (+) sign is assigned for beneficial interaction, (–) sign is assigned for detrimental interaction and (0) for neutral interaction. Which of the following interactions can be assigned (+) for one specifies and (–) for another specifies involved in the interaction?
(1) Competition

(2) Predation
(3) Amensalim
(4) Commensalism

Answer: (2)

Explanation:

Predation is a relationship in which members of one species (the predator) consume members of another species (the prey). In this predation one species is benefitted (+) whereas the other is harmed (-). It is (+ –) type of population interaction. As the prey population increases, there is more food for predators. So, after a slight lag, the predator population increases as well. As the number of predators increases, more preys are captured. As a result, the prey population starts to decrease.



Chapter Name: Ecosystem

137. If a geneticist uses the blind approach for sequencing the whole genome of an organism, followed by assignment of function to different segments, the methodology adopted by him is called as:
(1) Bioinformatics
(2) Sequence annotation
(3) Gene mapping
(4) Expressed sequence tags

Answer: (2)

Explanation: Sequencing is the total DNA from a cell is isolated and converted into random fragments of relatively smaller sizes and cloned in suitable host using specialized vectors. The cloning resulted into amplification of each piece of DNA fragment so that it subsequently could be sequenced with ease. The methods involved two major approaches. One approach focused on identifying all the genes that are expressed as RNA referred to as Expressed Sequence Tags (ESTs). The other took the blind approach of simply sequencing the whole set of genome that contained all the coding and non-coding sequence, and later assigning different regions in the sequence with functions. This referred to as Sequence Annotation.

Chapter Name: Molecular Basis of Inheritance

138. Which of the following occurs due to the presence of autosome linked dominant trait?
(1) Thalessemia
(2) Sickle cell anaemia
(3) Myotonic dystrophy
(4) Haemophilia

Answer: (3)

Explanation:

Thalassemia is an autosomal recessive disorder. **Sickle cell anaemia** is an autosomal recessive disorder. **Myotonic dystrophy** is an autosomal dominant disorder i.e. it occurs due to the presence of autosomal linked dominant trait. Autosomal dominant is a pattern of inheritance characteristic of some genetic disorders. “Autosomal” means that the gene in question is located on one of the numbered, or non-sex, chromosomes. “Dominant” means that a single copy of the mutated gene (from one parent) is enough to cause the disorder. A child of a person affected by an autosomal dominant condition has a 50% chance of being affected by that condition via inheritance of a dominant allele. By contrast, an autosomal recessive disorder requires two copies of the mutated gene (one from each parent) to cause the disorder. **Haemophilia** is a X-linked recessive disorder.

Chapter Name: Principles of Inheritance and Variations

139. Which one of the following will accelerate phosphorus cycle?
(1) Rain fall and storms
(2) Burning of fossil fuels
(3) Volcanic activity

(4) Weathering of rocks

Answer: (4)

Explanation:

Phosphorus is indispensable to life on Earth, as it is involved in the passage of genetic information, energy transfer, and the construction of plant cells. Despite this, the amount of phosphorus available for biological uptake is relatively small, so productivity in many terrestrial and aquatic ecosystems is often limited by phosphorus availability. Phosphorus cycle is a sedimentary cycle. Reservoir pool of phosphorus in ecosystem is the earth's crust or lithosphere. Weathering of rocks accelerates phosphorus cycle. Weathering makes phosphate available to the soil. Phosphorus is a critical element. It is obtained from the soil as orthophosphate.

Chapter Name: Ecosystem

140. 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) Gingely 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 option given below:

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

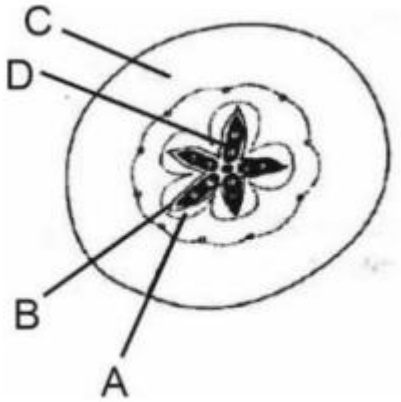
Answer: (4)

Explanation:

Option (4) is the correct answer because statements (c), (d) and (e) are correct as oils have lower melting point and hence remain oil in winters. Lipids are generally insoluble in water but soluble in some organic solvents. Option (1), (2) and (3) are incorrect because statements (a) and (b) are incorrect. Lecithin is a type of phospholipid found in plasma membrane. Saturated fatty acids are without double bond.

Chapter Name: Biomolecules

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

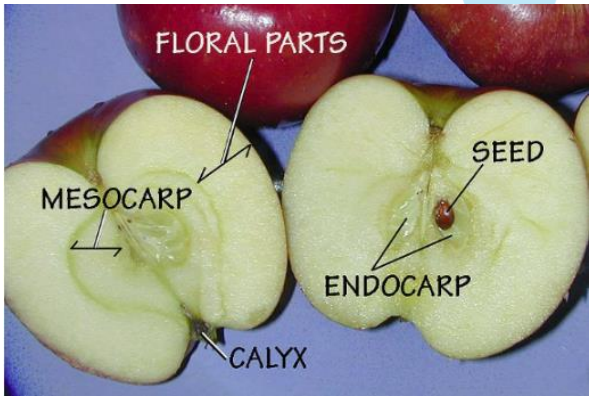


(1) D → Seed
(2) A → Mesocarp
(3) B → Endocarp
(4) C → Thalamus

Answer: (4)

Explanation:

The above given fig. is of a false fruit. The fruits are formed from the ovary of a flower after fertilization. Such fruits that develop from the ovary are called true fruits. On the other hand, fruits formed from any part of the flower other than ovary are called false fruits. False fruit develops from other floral parts and thalamus along with the development of ovary wall. E.g. Apple is called a false fruit because it develops from the thalamus and not from the ovary.



Chapter Name: Morphology of Flowering Plants

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

(1) 5′GTATTC3′; 3′CATAAG5′
(2) 5′GATACT3′; 3′CTATGA5′
(3) 5′GAATTC3′; 3′CTTAAG5′
(4) 5′CTCAGT3′; 3′GAGTCA5′

Answer: (3)

Explanation:

Option (3) is the correct answer as a palindromic DNA sequence is a DNA sequence of base pairs that reads same on the two strands when orientation of reading is kept the same. Out of the four options, option (3) is the only palindromic sequence.

(A)

A palindromic sequence on two complementary strands

Chapter Name: Molecular Basis of Inheritance

143. 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:

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

Answer: (4)

Explanation:

According to Mendel hereditary units later called genes had the capacity to form a part of the reproductive gamete independent of other factors or genes.

But since, genes are located on the chromosomes and it is the property exhibited by the homologous chromosomes to assort or combine with other chromosomes (non-homologous) of the diploid set, in order to form a complete but distinct genome in the gametes and consequently the offspring.

Therefore, Mendel's law of independent assortment does not hold true for the genes that are located closely. Closely located genes do not show independent assortment. Mendel's law of independent assortment holds good for those genes which are located on different chromosomes.

Chapter Name: Principles of Inheritance and Variation

144. The entire fleet of buses in Delhi was converted to CNG from diesel. In reference to this, which one of the following statements is false?
(1) It cannot be adulterated like diesel
(2) CNG burns more efficiently than diesel
(3) The same diesel engine is used in CNG buses making the cost of conversion low
(4) It is cheaper than diesel

Answer: (3)

Explanation:

Out of the 41 most polluted cities in the world in the 1990s, Delhi was listed as the fourth most polluted city. The Delhi government was ordered by the Supreme Court to replace all of its public transportation vehicles' use of diesel fuel with compressed natural gas (CNG, buses).

CNG is an odourless blend of hydrocarbons, primarily methane, that has been compressed to 1% of its original volume at standard atmospheric pressure. The primary factor in the decision was that CNG burns more effectively than gasoline or diesel and emits fewer hazardous pollutants into the atmosphere. The fact that CNG is less expensive and cannot be stolen or tampered with are further benefits.

However, the primary challenge the administration had during this transition was installing pipelines all across the city to guarantee a constant supply of CNG at numerous outlets. All Delhi buses had switched to CNG by the end of 2002, despite all obstacles.

Chapter Name: Environmental Issues

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

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

Answer: (3)

Explanation:

Bundle sheath cells are a layer of cells in plant leaves and stems, that forms a sheath surrounding the vascular bundles. In C4 plants the bundle sheath cells contain chloroplasts and are the site of the Calvin cycle. The initial fixation of carbon dioxide to form malic acid takes place in the palisade mesophyll cells, which in C4 plants form a circle around the bundle sheath. This arrangement, known as Kranz anatomy or structure (after the German Kranz, wreath), ensures that the palisade cells are in close contact with the bundle sheath cells, so that the malic acid can easily pass to the bundle sheath. It also means that the products of photosynthesis can be quickly transferred from the bundle sheath to the adjacent phloem tissue for transport to other parts of the plant.

Chapter Name: Photosynthesis in Higher Plants.

146. Transposons can be used during which one of the following?

(1) Gene sequencing
(2) Polymerase Chain Reaction
(3) Gene Silencing
(4) Autoradiography

Answer: (3)

Explanation:

Option (3) is the correct answer as the source of the complementary RNA for RNAi could be mobile genetic elements (transposons) that replicate via an RNA intermediate.

Option (4) is incorrect as autoradiography usually follows hybridization.

Option (2) is incorrect because polymerase chain reaction is used to make copies of the DNA sample and does not need transposons.

Option (1) is incorrect because transposons are not required during gene sequencing.

Chapter Name: Application of Biotechnology

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

Answer: (3)

Explanation:

Spirogyra is a filamentous charophyte green alga. It shows haplontic life-cycle.

Fern is pteridophyte. Pteridophytes are vascular plants that produce spores. These include ferns, horsetails, clubmoss, and spikemoss. The dominant phase of life-cycle is diploid sporophyte. Its gametophyte is called prothallus.

Funaria is a bryophyte. Funaria, or club moss basically has two phases of growth, the gametophytic and sporophyte phase which is a parasite on the gametophyte for nutrition. Its gametophyte is a leafy stage.

Cycas is classified as gymnosperms as it has naked ovule. Because of naked ovule, all gymnosperms form naked seed which differentiate them from angiosperms. The main plant body in gymnosperm is sporophyte. They have highly reduced gametophyte stage.

Chapter Name: Plant Kingdom

148. Addition of more solutes in a given solution will:

(1) not affect the water potential at all
(2) raise its water potential
(3) lower its water potential
(4) make its water potential zero

Answer: (3)

Explanation:

The water potential of a solution can be determined using pure water as the standard of reference. The pure water, at atmospheric pressure, has a water potential of zero(0). The addition of solute particles reduces the free energy of water and thus decreases the water potential(negative value). The magnitude of this lowering due to dissolution of a solute is called solute potential.

Chapter Name: Transport in Plants

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:

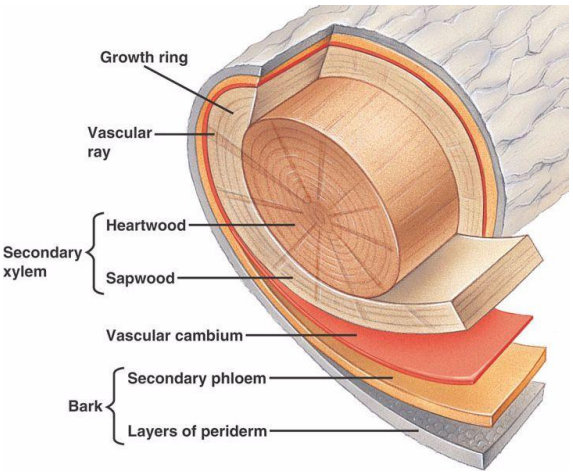
(1) (c), (d) and (e) Only
(2) (a), (b), (d) and (e) Only
(3) (a), (c), (d) and (e) Only
(4) (a), (b) and (d) Only

Answer: (3)

Explanation:

The peripheral region of the secondary xylem is lighter in colour and has a lower density. This is termed as sapwood. The vessels are produced with the wider lumens to transport more water to meet the requirement by increased transpiring surface in spring season. The spring and autumn wood appear as alternate concentric rings of light and dark colour forming annual rings.

In the trunk and older branches of large trees, only the outer secondary xylem which is sapwood serves in water conduction, while the inner part which is heartwood is composed of dead but structurally strong xylem.



Chapter Name: Anatomy of Flowering Plants

150. Match List-I with List-II.

List-I		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)	Submetacentric	(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)-(ii), (c)-(iii), (d)-(iv)
(2) (a)-(iii), (b)-(i), (c)-(iv), (d)-(ii)
(3) (a)-(i), (b)-(iii), (c)-(ii), (d)-(iv)
(4) (a)-(ii), (b)-(iii), (c)-(iv), (d)-(i)

Answer: (2)

Explanation:

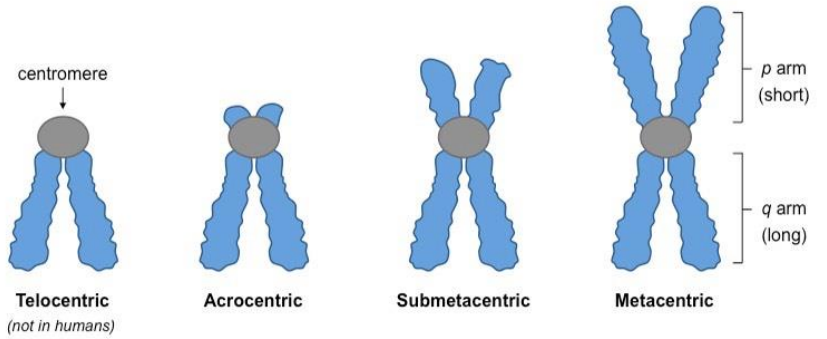
Chromosomes are divided into two parts (p and q arms) with a constriction point called a centromere in the middle. The centromere can be located in different positions and this forms the basis for the four different classes of chromosome:

Metacentric – centromere is in middle, meaning p and q arms are of comparable length

Submetacentric – centromere off-centre, leading to shorter p arm relative to q

Acrocentric – centromere severely off-set from centre, leading to much shorter p arm

Telocentric – centromere found at end of chromosome, meaning no p arm exists (chromosome not found in humans)



Chapter Name: Principles of Inheritance and Variation

151. Under normal physiological conditions in human being every 100 ml of oxygenated blood can deliver _____ ml of O2 to the tissues.
(1) 10 ml
(2) 2 ml
(3) 5 ml
(4) 4 ml

Answer- (3)

Explanation:

Blood carries oxygen from lungs to heart and from there to different cells. Oxygen is transported in dissolved form as oxyhaemoglobin. O_2 binds with Hb at the lung's surface and dissociates near tissues due to increase in acidity and decrease in pH. In normal person, the haemoglobin level is about 15 g per 100 ml and 1g of haemoglobin can combine with 1.34 ml O_2. Under normal condition, in venules (very small vein connecting the capillary with large vein) O_2 level falls to about 14.4

ml/100ml. It indicates that under normal physiological conditions, approx 5ml oxygen is delivered by 100 ml of oxygenated blood to tissue. While during exercise, approx 15ml of oxygen is delivered by oxygenated blood to the metabolically active tissues.

Chapter Name: Breathing and Exchange of Gases

152. Nitrogenous waste is excreted in the form of pellet or paste by:
(1) Pavo
(2) Ornithorhynchus
(3) Salamandra
(4) Hippocampus

Answer- (1)

Explanation:

Uricotelic animals excrete nitrogenous wastes as uric acid in the form of pellet or paste because uric acid is insoluble in water. This leads to the minimal loss of water. It is very important for vertebrates laying shelled eggs. For example, reptiles, birds, land snail and insects. *Pavo* is the genus of bird with only two species turkey and peacock excrete uric acid. While *Ornithorhynchus* is an egg laying mammal excrete nitrogenous waste as urea, *Salmandra* is genus of amphibian and excrete nitrogenous waste as ammonia or urea, *Hippocampus* is a genus of fish and excrete nitrogenous wastes as ammonia or urea. Thus, the correct answer is option 1.

Chapter Name: Excretory Products and their Elimination

153. Which of the following is present between the adjacent bones of the vertebral column?
(1) Smooth muscle
(2) Intercalated discs
(3) Cartilage
(4) Areolar tissue

Answer- (3)

Explanation:

Vertebral column or backbone or spine has a row 33 movable articulated ring like bones called as vertebrae. Between the adjacent vertebrae are cartilaginous

intervertebral discs. It helps vertebrae to held together and prevent their dislocation. It makes backbone flexible and permits a degree of movement.

While intercalated disc is the gap junction that links cell together and allows electrical impulse conduction. It is located in cardiac muscle.

Smooth muscle is not associated with the bones but occurs in the internal organs. It is responsible for internal organ movement. For example stomach wall contraction for digestion is done by smooth muscle.

Areolar tissue is a loose connective tissue. It attaches the skin with muscle, blood vessels and nerves with surrounding tissues. It is also responsible for tissue repair.

Thus, the correct answer is option 3.

Chapter Name: Locomotion and Movement

154. In-situ conservation refers to:

(1) Conserve only extinct species
(2) Protect and conserve the whole ecosystem
(3) Conserve only high-risk species
(4) Conserve only endangered species

Answer- (2)

Explanation:

In-situ conservation is one of the conservation methods, where species are protected in their natural habitat by making their habitats protected areas or conserving the whole ecosystem. For example- national parks, sanctuaries, biosphere reserves, etc.

Chapter name: Biodiversity and Conservation

155. Given below are two 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 options given below:

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

Answer- (4)

Explanation:

Autoimmune disorder is a condition where body immune system fails to recognize its own cells and considering as foreign body. They start destroying own cells. This immunity is called as autoimmunity. Rheumatoid arthritis is one of the examples of autoimmune disease. In this disease, immune complex of IgM, IgG and complements are deposited in the joints and start destroying articular cartilage and fusing bones. Thus, the correct answer is option 4.

Chapter Name: Human Health and Disease

156. Which of the following is not the function of conducting part of respiratory system?
(1) Provides surface for diffusion of O_2 and CO_2
(2) It clears inhaled air from foreign particles
(3) Inhaled air is humidified
(4) Temperature of inhaled air is brought to body temperature

Answer- (1)

Explanation:

The conducting part of respiratory system starts with the external nostrils upto the bronchioles whereas the alveoli and their ducts form the respiratory or exchange part of the respiratory system. The conducting part transports the atmospheric air to the alveoli, clears it from foreign particles, humidifies and also brings the air to body temperature. Exchange part is the site of actual diffusion of O_2 and CO_2 between blood and atmospheric air that occurs in the alveoli. Thus, the correct answer is option 1.

Chapter name: Breathing and Exchange of Gases

157. Given below are two statements:

Statement I: The coagulum is formed of network of threads called thrombins.

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

Answer- (1)

Explanation:

An injury stimulates the thrombocytes in the blood to release thromboplastin. Thromboplastin helps in the formation of enzyme complex called thrombokinase which converts prothrombin (inactive) into thrombin (active). Thrombin then converts soluble fibrinogen into the insoluble fibrin. Fibrin forms a network of thread that traps dead or damaged formed elements of blood to form clot or coagulum.

Spleen is a large bean shaped secondary lymphoid organ. It acts as a filter of blood by trapping old or damaged RBC and destroys them. Hence, spleen is called as graveyard of RBC or erythrocytes.

Thus, the correct answer is option 1.

Chapter Name: Body Fluid and Circulation

158. 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 option given below:

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

Answer- (2)

Explanation:

Chordates are fundamentally characterized by the presence of a notochord, dorsal nerve cord and paired pharyngeal gill slits. In vertebrates notochord is present in embryonic stage but it is replaced by vertebral column in the adults. Thus, all vertebrates are chordates but all chordates are not vertebrates.

Chapter Name: Animal Kingdom

159. 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 chance of fractures.

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

Answer- (4)

Explanation:

Osteoporosis is a skeletal disorder where bone loses its minerals and fibres from the matrix. The loss of minerals and fibres from the matrix decreases the bone mass and causes osteoporosis. It is mainly caused due to imbalance of hormones like calcitonin and parathrome and decrease of sex hormone such as estrogen. As the bone mass decreases the bone becomes more prone to fractures.

Chapter name: Locomotion and Movement

160. 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) Statement I is incorrect but Statement II is correct

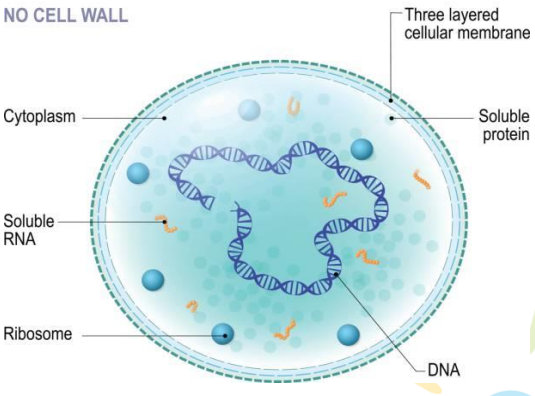
(2) Both Statement I and Statement II are correct
(3) Both Statement I and Statement II are incorrect
(4) Statement I is correct but Statement II is incorrect

Answer- (4)

Explanation:

Mycoplasma is the smallest prokaryote with size 0.3µm to 0.5µm. They lack cell wall and hence can pass through bacteriological filter.

Mycoplasma



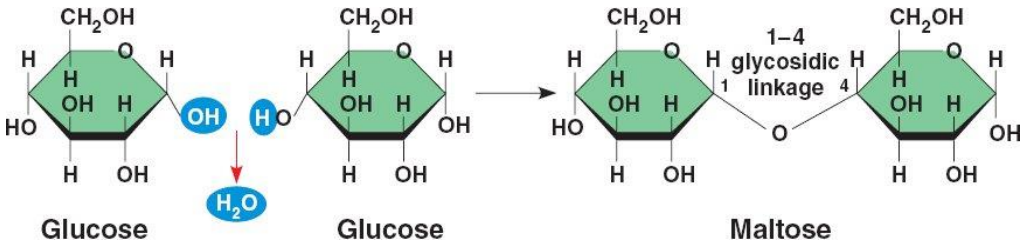
Chapter Name: Biological Classification

161. A dehydration reaction links two glucose molecules to product maltose. If the formula for glucose is C6H12O6 then what is the formula for maltose?
(1) C12H24O11
(2) C12H20O10
(3) C12H24O12
(4) C12H22O11

Answer- (4)

Explanation:

Maltose is a disaccharide formed by dehydration process. In this process two glucose molecules combines to form single molecule of maltose by eliminating one molecule of water to form a glycosidic bond in between two glucose molecules. So, its molecular formula will be C12H22O11.



Chapter Name: Biomolecule

162. Regarding Meiosis, which of the statements is incorrect?

(1) Four haploid cells are formed at the end of Meiosis-II
(2) There are two stages in Meiosis, Meiosis-I and II
(3) DNA replication occurs in S phase of Meiosis-II
(4) Pairing of homologous chromosomes and recombination occurs in Meiosis-I

Answer- (3)

Explanation:

Cell cycle is the sequence of events by which cell duplicates its genome and eventually divides into two daughter cells. It has two phases-

1. Inter phase
2. M phase.

Interphase is a non-dividing phase. It is further divided into 3 phases- G1, G2 and S. S phase is a phase in which replication of DNA takes place.

M phase is a dividing phase. It is divided into 2 categories- mitosis and meiosis.

Cell divides mitotically and produces 2 diploid daughter cells. Meiosis is the reductional division where diploid cell divides to form haploid cells. It has 2 stages meiosis I and meiosis II. In prophase I of meiosis I formation of homologous chromosome from chromatin take place. These homologous chromosomes come to lie side by side in pairs then non-sister chromatids of chromosome cross over which leads to recombination. By the end of meiosis II 1 diploid is divided into 4 haploid cells. Thus, the correct answer is option 3.

Chapter Name: Biological Classification

163. Natural selection where more individuals acquire specific character value other than the mean character value, leads to

(1) Random change

(2) Stabilising change
(3) Directional change
(4) Disruptive change

Answer- (3)

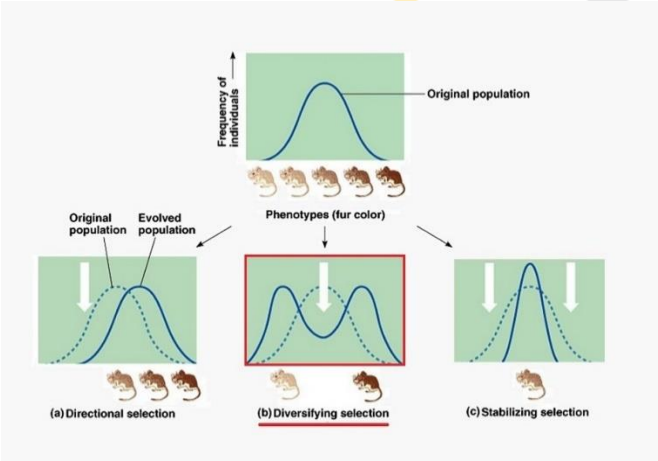
Explanation:

Natural selection is a process by which those organisms which appear physically, physiologically and behaviourally better adapted to environment, survive and reproduce. It has 3 types:

Stabilising change/selection: This selection favors average sized individual while eliminates small size. It maintains the mean value from generation to generation.

Directional change/selection: The population changes towards one direction. It favors small or large sized individuals and more individual of that type will be present in next generation.

Disruptive change/selection: It favors both small sized and large sized individual. It eliminates most of the members with mean expression. So distribution of traits leads to the development of two different populations.



Natural selection is not random. Thus, the correct answer is option 3.

Chapter Name: Evolution

164. In gene therapy of Adenosine Deaminase (ADA) deficiency, the patient requires periodic infusion of genetically engineered lymphocytes because:
(1) Genetically engineered lymphocytes are not immortal cells.
(2) Retroviral vector is introduced into these lymphocytes.

(3) Gene isolated from marrow cells producing ADA is introduced into cells at embryonic stages
(4) Lymphocytes from patient's blood are grown in culture, outside the body.

Answer- (1)

Explanation:

ADA deficiency is a very rare genetic disease. Adenosine deaminase enzyme is important for the immune system to function. It is caused due to deletion of the gene for adenosine deaminase. It leads to the SCID disorder. This disorder can be treated by gene therapy. First step of gene therapy is the extraction of lymphocytes from bone marrow of patient and grown in a culture medium outside the body. A functional ADA c-DNA then introduced (by using retrovirus vector) into these lymphocytes, which are reinjected into the patient's bone marrow. But these cells do not always remain alive and patient requires periodic infusion of genetically engineered lymphocytes. If the isolated gene from bone marrow cells producing ADA is introduced into cells at early embryonic stages, it can be permanent cure. Thus, the correct answer is option 1.

Chapter Name: Application of Biotechnology

165. If '8' Drosophila in a laboratory population of '80' died during a week, the death rate in the population is _____ individuals per Drosophila per week.
(1) zero
(2) 0.1
(3) 10
(4) 1.0

Answer- (2)

Explanation:

An individual may have birth or death but a population has birth rate and death rate. In a population death rate refer to per capita death i.e., ratio of the number of individual to the total number of individuals in a population.

So death rate of Drosophila in a laboratory = 8/80 = 0.1

Thus, the correct answer is option 2.

Chapter Name: Organisms and Population

166. In the taxonomic categories which hierarchical arrangement in ascending order is correct in case of animals?

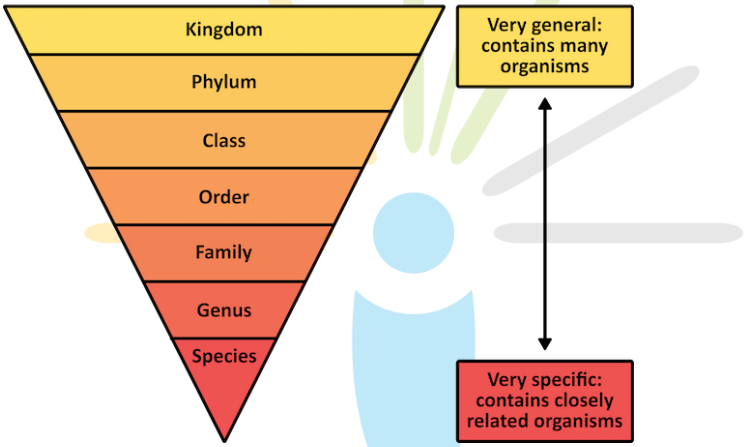
(1) Kingdom, Order, Phylum, Class, Family, Genus, Species
(2) Kingdom, Phylum, Class, Order, Family, Genus, Species
(3) Kingdom, Class, Phylum, Family, Order, Genus, Species
(4) Kingdom, Order, Class, Phylum, Family, Genus, Species

Answer- (2)

Explanation:

The taxonomic category is a hierarchical sequence of categories in a decreasing or increasing order from kingdom to species and vice versa.

The kingdom has the highest rank followed by phylum, class, order, family, genus, and species. Species has the lowest rank in the hierarchy. Kingdom is the topmost taxonomic category.



Chapter Name: The Living World

167. 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:

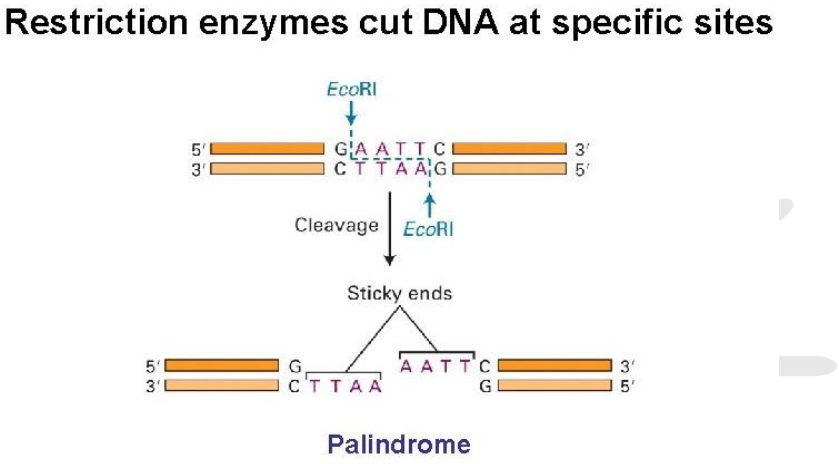
(1) Statement I is incorrect but Statement II is correct
(2) Both Statement I and Statement II are correct

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

Answer- (2)

Explanation:

Restriction endonuclease reads the length of DNA sequence. Once it recognizes the specific sequence, it binds to the DNA and cuts both the DNA sequence at specific point. Special sequence in DNA recognized by restriction endonuclease is called palindromic sequence. Palindromic sequences are the same when read forward or backward from central axis of symmetry. Restriction enzyme cut the strand of DNA a little away from the centre of the palindrome site but between the same two bases of the opposite strand.



Chapter Name: Biotechnology: Principles and Processes

168. Breeding crops with higher levels of vitamins and minerals or higher proteins and healthier fats is called:
(1) Bio-accumulation
(2) Bio-magnification
(3) Bio-remediation
(4) Bio-fortification

Answer- (4)

Explanation:

Breeding crops with higher levels of vitamins and minerals or higher proteins and healthier fats is called Biofortifiction. This is the most practical aspects to improve the health of people by increasing the nutritional quality of food i.e., golden rice. Golden rice is fortified with vitamin A.

Bioaccumulation is the gradual accumulation of substances or chemicals in an organism. For example, mercury contamination where small fishes feeds on phytoplanktons and accumulate mercury.

Biomagnification is a process where chemicals transfer from lower trophic levels to higher trophic levels within a food web, resulting in a higher concentration in apex predators. For example, magnification of DDT from phytoplankton to fish eating bird.

Bioremediation is a process where living organisms like microbes or plants are used to neutralize pollutants from the environment. For example, *Pseudomonas putida* is used to remove oil spills.

Chapter Name: Strategies for Enhancement in Food Production

169. Identify the microorganism which is responsible for the production of an immunosuppressive molecule cyclosporin A:
(1) Streptococcus cerevisiae
(2) Trichoderma polysporum
(3) Clostridium butylicum
(4) Aspergillus niger

Answer- (2)

Explanation:

Cyclosporin A is an immunosuppressant which inhibits the activation of T-cells and therefore, prevents rejection reactions in organ transplantation. It is obtained through fermentative activity of fungus *Trichoderma polysporum*.

While *Streptococcus cerevisiae* is not a single species *cerevisiae* is the species of yeast (baker's yeast) and its name is *Saccharomyces cerevisiae* used for making bread. *Streptococcus* is the genus of gram positive bacteria. It has many species like *lactis, cremoris, feacalis* etc. *S.lactis* and *S. cremoris* is used to produce lactic acid. *S. feacalis* is genetically modified to produce streptokinase (clot buster).

Clostridium butylicum is used to obtain acetone and butanol through fermentative activity.

Aspergillus niger is a species of fungi used to obtain gluconic acid and citric acid.

Thus, the correct answer is option 2.

Chapter Name: Microbes in Human Welfare

170. Which of the following is a correct match for disease and its symptoms?

(1) Muscular dystrophy – An auto immune disorder causing progressive degeneration of skeletal muscle
(2) Arthritis – Inflammed joints
(3) Tetany – High Ca2+ level causing rapid spasms.
(4) Myasthenia gravis – Genetic disorder resulting in weakening and paralysis of skeletal muscle.

Answer- (2)

Explanation:

Muscular dystrophy is a genetic disorder in which protein dystrophin is not formed. This protein is essential for muscle contraction. It causes difficulty in running, jumping, walking and leaning, muscle pain and stiffness.

Arthritis is a disorder of inflamed joints. It causes pain, swelling, redness and heat in the joints.

Tetany is the rapid spasm in muscles because of lesser Ca^{2+} in the body fluid.

Myasthenia gravis is an autoimmune disorder where antibodies start attacking acetylcholine receptors on sarcolemma due to which neurotransmitter does not bind to its receptor and does not initiate nerve transmission. It is characterized by the weakening and paralysis of skeletal muscle. Thus, the correct answer is option 2.

Chapter Name: Locomotion and Movement

171. Which of the following statements with respect to Endoplasmic Reticulum is incorrect?

(1) SER are the sites for lipid synthesis
(2) RER has ribosomes attached to ER
(3) SER is devoid of ribosomes
(4) In prokaryotes only RER are present

Answer- (4)

Explanation:

Endoplasmic reticulum is membrane bounded organelle and a part of endomembrane system. It is found only in eukaryotic cell. It is of two types rough endoplasmic reticulum (RER) and smooth endoplasmic reticulum (SER). ER bears ribosome on its surface is called RER. Because of the presence of ribosome RER is responsible for formation and transportation of protein. ER which is devoid of

ribosome is called SER. It is specialized in the synthesis of lipids and steroid. Thus, the correct answer is option 4.

Chapter Name: Cell: the Unit of Life

172. 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 sperms from spermatogonia.

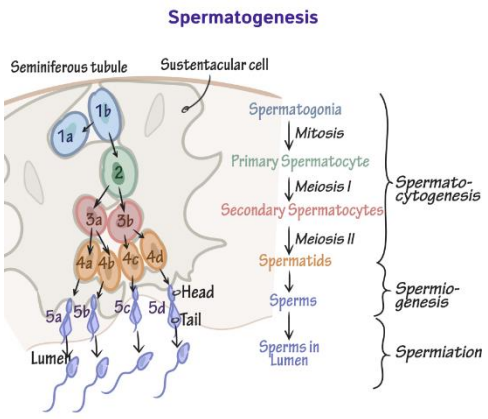
In the light of the above statements, choose the most appropriate answer from the options given below:

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

Answer- (4)

Explanation:

Spermatogenesis is the process where sperm cells are produced from spermatogonia that present on the inner wall of seminiferous tubule. Spermatogonia undergo two successive divisions and by the end of meiosis II 4 haploid spermatids are formed. Spermatids then transformed into the spermatozoa, this process of transformation is called as spermiogenesis. After spermiogenesis, sperm heads become embedded in the sertoli or sustentacular cells and are finally released from the seminiferous tubule by the process called spermiation.



Chapter Name: Human Reproduction

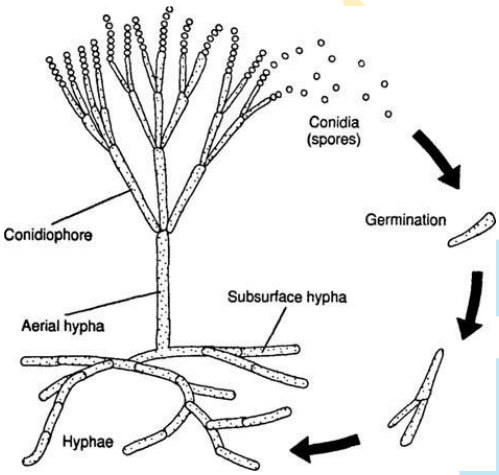
173. Identify the asexual reproductive structure associated with Penicillium:

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

Answer- (3)

Explanation:

Conidia are the asexual reproductive structures produced in *Penicillium*. They are non- motile spores produced singly or chain at the tip of conidiophores. While, gemmules (internal bud) are asexual reproductive structure in sponge. Buds are asexual reproductive structure in Hydra and yeast. Zoospores are motile flagellated spores that help in asexual reproduction in *Chlamydomonas.* Thus, the correct answer is option 3.



Chapter Name: Reproduction in Organisms

174. In an *E. Coli* strain i gene gets mutated and its product cannot bind the inducer molecule. If growth medium is provided with lactose, what will be the outcome?

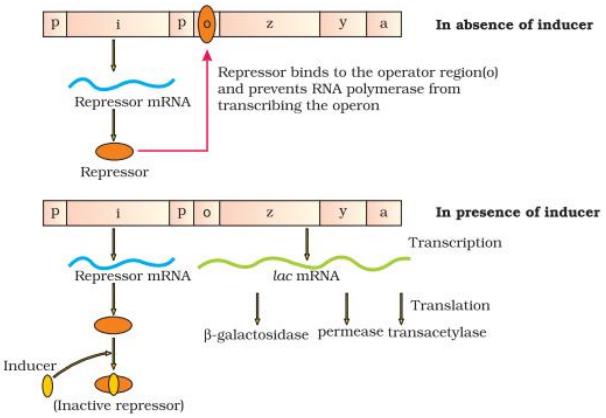
(1) RNA polymerase will bind the promoter region
(2) Only z gene will get transcribed
(3) z, y, a genes will be transcribed
(4) z, y, a genes will not be translated

Answer- (4)

Explanation:

In E.coli, breakdown of lactose requires 3 enzymes: z gene codes for beta galactosidase3, y gene codes for permease and a gene codes for trasacetylase. Gene

i is the regulatory gene that codes for repressor protein. When this repressor protein binds with the operator region it blocks the transcription and translation of z, y and a genes. In the presence of inducer (lactose), it prevents from binding to the operator by attaching with the inducer. As an i gene is mutated so it will not be able to produce specific repressor protein and hence, inducer can now no more capable of binding with the repressor. Thus, in all the cases, operator always gets attached with the repressor thereby preventing the transcription and transmission of z, y and a. Even in the presence of lactose, transcription and translation of z, y and a genes would not occur. Thus, the correct answer is option 4.



Chapter Name: Molecular Basis of Inheritance

175. Tegmina in cockroach, arises from

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

Answer- (3)

Explanation:

The body of cockroach is divided into three main segments: head, thorax and abdomen. The thorax is further divided into three segment:

Anterior prothorax

Middle mesothorax

Posterior metathorax

Each thoracic segment bears ventrally a pair of jointed legs. Two pairs of wings are also found in thoracic region. The first pair of wings arises from mesothorax known

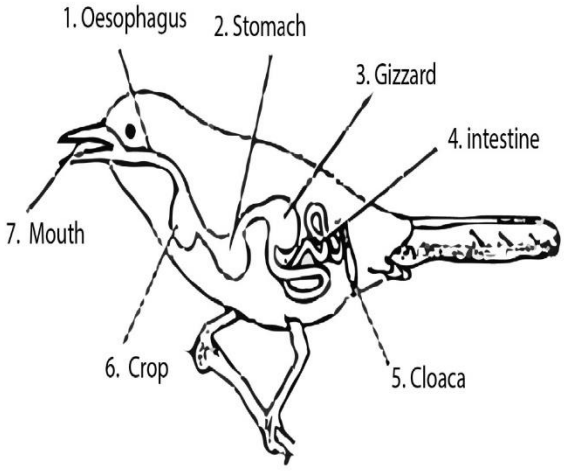
as fore wings. They are larger than the second pair. They are not used for flight but they cover and protect hind wings. Hence, they are called as tegmina. The second pair of wings arises from metathorax region known as hind wings. They are delicate, thin, and transparent. They are used for flight but in resting position they lie folded below the tegmina. While one pair of legs (pro-legs) arises from prothorax. Thus, the correct answer is option 3.

Chapter Name: Structural Organisation in Animals

176. In which of the following animals, digestive tract has additional chambers like crop and gizzard?
(1) Pavo, Psittacula, Corvus
(2) Corvus, Columba, Chameleon
(3) Bufo, Balaenoptera, Bangarus
(4) Catla, Columba, *Crocodilus*

Answer: (1)

Explanation: *Pavo* (peacock), *Psittacula* (parrot), *Corvus* (crow). All three of the above mentioned belong to class Aves and have a digestive tract with chambers like crop- which helps in storing food and gizzard which helps in grinding food. As all Avians have it in their digestive tract. So option 1) is the correct answer.



In option 2) Corvus and Columba(pigeon) belongs to the class Aves where as chameleon belongs to Reptilia, as reptiles do not show the presence of crop and gizzard it is an incorrect option

In option 3) bufo(frog) is an amphibian, balaenoptera(whale) belongs to Pisces and Bangarus (Indian krait) none of them belong to class Aves.so this option is incorrect

In option 4) Catla belongs to pieces, Crocodilus is a reptile and only Columba belongs to Aves , so it is also an incorrect option.

Chapter Name: The Animal Kingdom

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

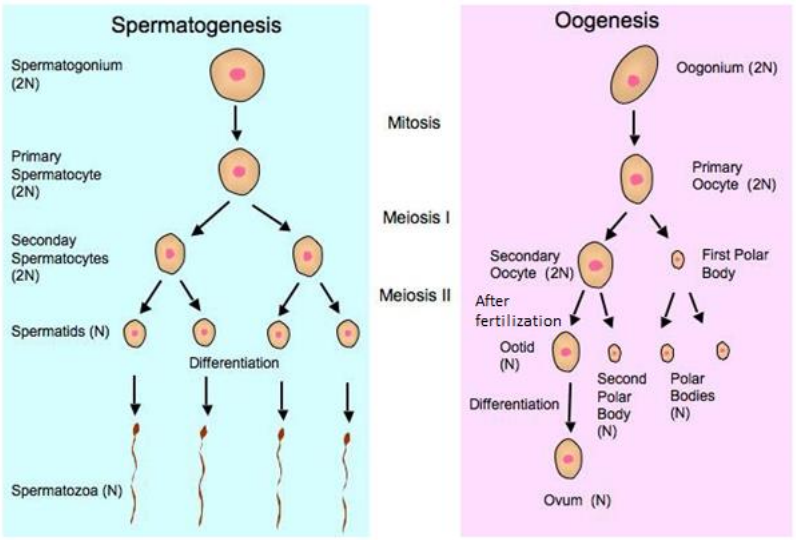
Answer: (1)

Explanation:

Differentiation of gamete occurs after the completion of meiosis-

Spermatogenesis is the process of formation of male gamete i.e., sperm cells. It involves multiplication phase, growth phase maturation phase and differentiation phase.

Multiplication phase has mitosis cell division to produce n numbers of spermatogonia. In growth phase, spermatogonia actively grow to a larger primary spermatocyte. In maturation phase, primary spermatocyte undergoes meiosis division and by the end of meiosis II 4 haploid spermatids are formed. In differentiation phase or spermiogenesis, spermatids are transformed to spermatozoa. Here differentiation is taking place after the completion of meiosis II. Whereas in oogenesis, differentiation occurs after fertilization because it halts the meiosis II before fertilization.



Meiosis occurs continuously in a mitotically dividing stem cell population.

Cells grow during the dominant G_1 phase. Replication of chromosomes occurs in the S phase. Preparation for mitosis takes place during G_2 - replication of organelles and synthesis of microtubules. Whereas the division at female gamete halts meiosis-II until its fertilization takes place.

It is initiated at puberty

In males, gametogenesis begins at puberty and continues into advanced age. Primordial germ cells (46,2N) migrate into the testes at week 4 of development and remain dormant. At puberty, primordial germ cells differentiate into type A spermatogonia (46,2N). Unlike sperm formation that starts at puberty, egg formation in females begin before birth but it is completed only after fertilization. All the eggs that are present in the female are developed in the foetal stage only.

Thus, the correct answer is option 1.

Chapter Name: Human Reproduction

178. Given below are two statements:

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

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:

(1) Statement I is incorrect but Statement II is correct

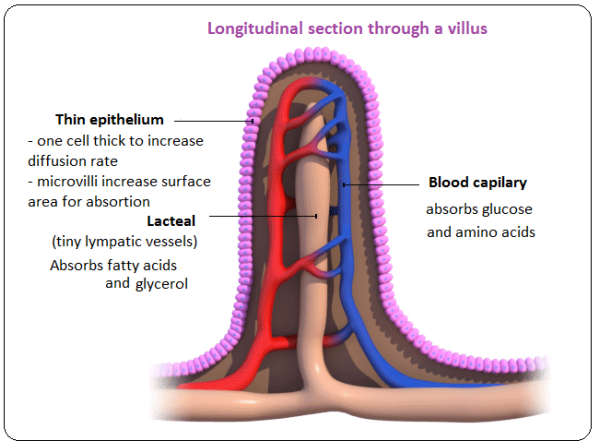
(2) Both Statement I and Statement II are correct
(3) Both Statement I and Statement II are incorrect
(4) Statement I is correct but Statement II is incorrect

Answer: (2)

Explanation:

Fatty acids and glycerol, being insoluble in water cannot be absorbed the blood directly. They are first modified into small droplets called micelles which move into intestinal mucosal cells. They're digested and absorbed into your bloodstream differently than carbs and proteins. At least that's true for most of the fats in your diet -- but not all of them. One group of fats -- medium-chain triglycerides -- is an exception.

Lacteals are blood capillaries and special lymph capillaries, in the center of each villus. The blood capillaries absorb most nutrients, but the fats and fat-soluble vitamins are absorbed by the lacteals. The lymph in the lacteals has a milky appearance due to its high fat content and is called chyle. Nearly all dietary lipid is transported in chylomicrons from the gut to the blood through the lymphatic system by entering specialized lymphatic vessels, referred to as lacteals, in the villi of the intestine.



Chapter Name: Digestion and Absorption in Humans.

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

Answer: (4)

Explanation:

IUD mainly work by changing the intra-uterine environment and making it spermicidal. Non-medicated IUD cause a sterile inflammatory response by producing a tissue injury of minor degree but sufficient enough to be spermicidal. The difference between a medicated and non-medicated IUD is that the hormone releasing IUDs make the uterus unsuitable for implantation and the cervix hostile for the sperms whereas the non-medicated IUDs prevent implantation of the Embryo.

Lippes Loop is a non-medicated IUD, this device is made of stainless steel or plastic (polyethene) impregnated with barium sulphate. The most frequent side effects of using these non-medicated IUDs are irregular uterine bleeding, pain in the lower abdomen, pelvic inflammatory disease (PID), etc. It is a plastic double "S" loop, a trapezoidal shaped IUD that closely fit the contours of the uterine cavity, thereby reducing the incidence of expulsion.

Lippe's loop

Chapter Name: Reproductive Health

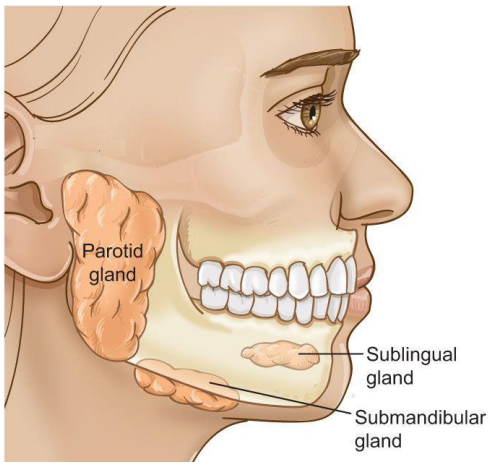
180. Which of the following functions is not performed by secretions from salivary glands?
(1) Digestion of disaccharides
(2) Control bacterial population in mouth
(3) Digestion of complex carbohydrates
(4) Lubrication of oral cavity

Answer: (1)

Explanation:

Salivary Glands are a group of organs present in our mouth that secretes saliva. It is found in mammals only. It is an exocrine gland that secretes substances outside the

body or within a body cavity. Saliva contains various chemicals with water including mucus, salts, antibacterial substances, enzymes and chemicals that control the pH in the mouth.



Chemical digestion: breaks down starch by the function of “salivary amylase”. It does not digest disaccharides. The disaccharides are broken down into monosaccharides by enzymes called maltases, sucrases, and lactases, which are also present in the brush border of the small intestinal wall. Maltase breaks down maltose into glucose. Helps chewing and swallowing. Lubricating effect: moisturizes the inside of the mouth and creates smoother speech. Solvent effect: dissolves food and allows the tongue to taste food. Cleaning effect: washes away food debris and bacteria remaining in the mouth. Antibacterial effect: Lysozyme, peroxidase and lactoferrin fight against pathogenic microorganisms. pH buffering effect: Prevents sudden changes in pH. Supplies minerals, including calcium and phosphorus, to teeth.

Chapter Name: Digestion and Absorption in Humans.

181. Which of the following is not a connective tissue?

(1) Neuroglia
(2) Blood
(3) Adipose tissue
(4) Cartilage

Answer (1)

Explanation:

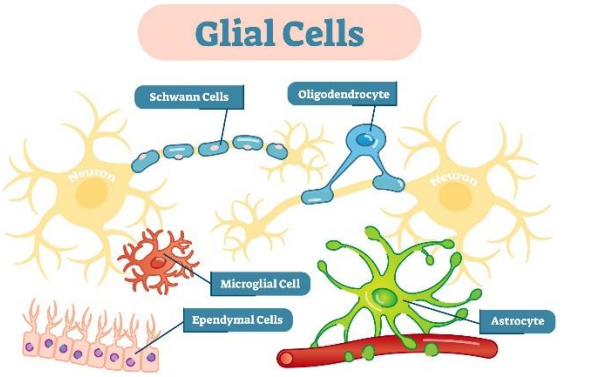
The connective tissue is the tissue that supports, protects, and gives structure to other tissues and organs in the body. Connective tissue also stores fat, helps move nutrients and other substances between tissues and organs, and helps repair

damaged tissue. Connective tissue is made up of cells, fibers, and a gel-like substance

Blood is a fluid connective tissue, **Adipose tissue** is a specialized connective tissue consisting of lipid-rich cells called adipocytes. **Cartilage** is a non-vascular type of supporting connective tissue that is found throughout the body.

The neuroglia is a diverse class of cells present in the nervous system that **provide developmental, physiological, and metabolic support for neurons**. They are responsible for maintaining homeostatic control and immune surveillance in the nervous system.

The Neuroglia in the Central nervous system comprises of, **Astrocytes**, they maintain the blood brain barrier and preserve the chemical environment by recycling ions and neurotransmitters. **Oligodendrocytes**, they myelinate axons in the central nervous system and provide an overall structural framework. **Ependymal cells** they line ventricles (brain) and central canal (spine) and are involved in the production of cerebrospinal fluid. **Microglia** they remove cell debris, wastes and pathogens via phagocytosis. There are two types of neuroglia found within the peripheral nervous system namely the **Schwann** cells they myelinate axons in the peripheral nervous system. The **Satellite cells** they regulate nutrient and neurotransmitter levels around neurons in ganglia. Thus, the correct answer is option 1.



THE NEUROGLIA

Chapter Name: Nervous Control and Co-ordination.

182. Detritivores breakdown detritus into smaller particles. This process is called:
(1) Decomposition
(2) Catabolism
(3) Fragmentation
(4) Humification

Answer (3)

Explanation:

Decomposition is the process of breaking complex organic matter into simple inorganic matter. Decomposition consists of five steps, namely

fragmentation

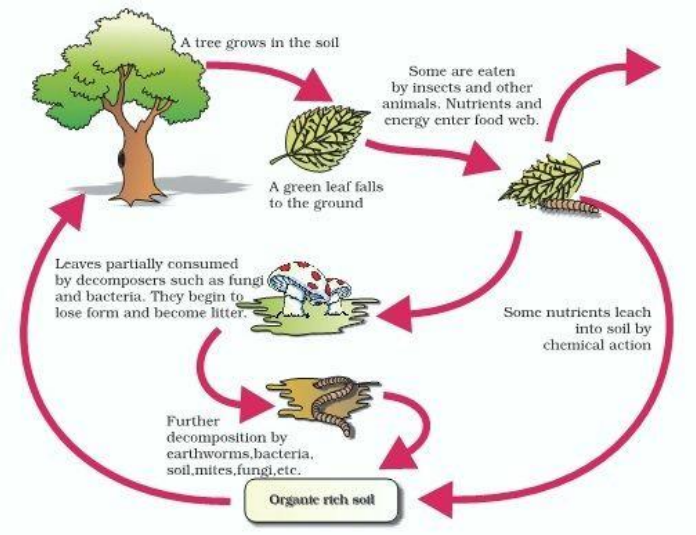
leaching

catabolism

humification

mineralization

fragmentation is the process of breaking of detritus into small pieces by earthworm. Fragmentation of detritus is **the process that causes breakdown of detritus into smaller particles**. It is primarily due to the action of detritus feeding invertebrates (detritivores, e.g., termites, earthworms, etc.,) The detritus gets pulverized when passing through the digestive tracts of animals. Leaching is the process of releasing nutrients in the water and seeping into the soil. Humification is the process of formation of dark coloured hummus and mineralization is the process of the degradation of the humus to release inorganic nutrients. Thus, the correct answer is option 3.



Chapter Name: Ecosystem

183. Select the incorrect statement with reference to mitosis:

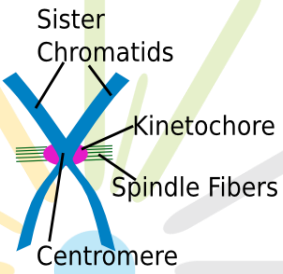
(1) Splitting of centromere occurs at anaphase

(2) All the chromosomes lie at the equator at metaphase
(3) Spindle fibres attach to centromere of chromosomes
(4) Chromosomes decondense at telophase

Answer (3)

Explanation:

All the options are correct except for option 3, the correct explanation of option 3 is. It is during the **prophase the condensation** of chromatin takes place. It is at **Kinetochores** which is a specialised **region on the centrosome**, the spindle fibres get attached. The centromere is a part of the chromosome that links with the sister chromatids. Thus during mitosis spindle fibres attach to centromere via the kinetochore. Kinetochore generates kinetochore fibres, which attach sister chromatids to spindle fibres. With the help of spindle polar fibres and kinetochore fibres the chromosome gets separated during mitosis and meiosis.



DIAGRAMATIC REPRESENTATION OF SPINDLE FIBRE ATTACHING TO KINETOCHORE

Chapter Name: Cell Cycle & Division

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

Answer (2)

Explanation:

Length of DNA molecule = distance between one base-pair to another base-pair x total no of base-pairs in that strand.

L = D x X

$= 0.34 \times 10^{-9} \times X$

$$X = \frac{1.1}{0.34 \times 10^{-9}}$$

$$X = \frac{1.1 \times 10^{9}}{0.34}$$

$X = 3.3 \times 10^{9}$ bp

Thus option 2 is the correct answer.

Chapter Name: Molecular Basis of Inheritance

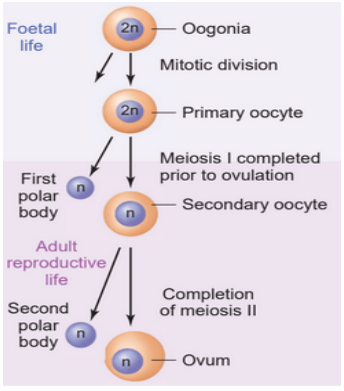
185. At which stage of life the oogenesis process is initiated?

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

Answer (3)

Explanation:

Oogenesis is initiated during the **embryonic stage** of a female fetus. Oogenesis occurs **in the outermost layers of the ovaries**. Oogenesis starts with a germ cell called oogonium and undergoes mitosis to increase in number. This happens in the ovaries or female gonads. There are three phases to oogenesis;
namely, **multiplication phase, growth phase and maturation phase**. This last phase is usually completed in the **ampulla of the fallopian tube** at the time of fertilization. Oocyte completes oogenesis when a sperm enters the secondary oocyte.



Chapter Name: Human Reproduction

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

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

Answer (1)

Explanation:

0A cloning vector is a small piece of DNA that can be stably maintained in an organism, and into which a foreign DNA fragment can be inserted for cloning purposes. The cloning vector may be DNA taken from a virus, the cell of a higher organism, or it may be the plasmid of a bacterium. Below are some of the desirable features of cloning vectors.

It must be self-replicating

It must have an site for origin of replication

It should have **at least one cloning site(recognition site)**

Presence of a marker gene

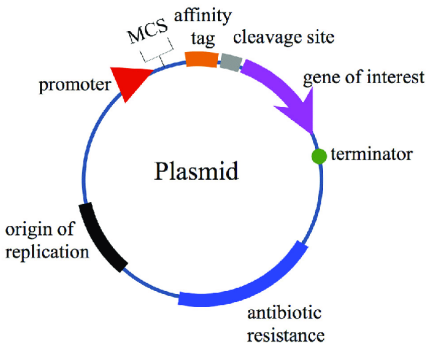
Presence of single restriction enzyme site

It should have a low molecular weight

It must be easily isolated and purified

Easily isolates in the host cell.

So the cloning vector must have at least one recognition site and does not require two or three recognition sites.



Desirable features in cloning vector

Chapter Name: Biotechnology: Principle and Process

187. Select the incorrect statement regarding synapses:

(1) Impulse transmission across a chemical synapse is always faster than that across an electrical synapse.

(2) The membranes of presynaptic and postsynaptic neurons are in close proximity in an electrical synapse.

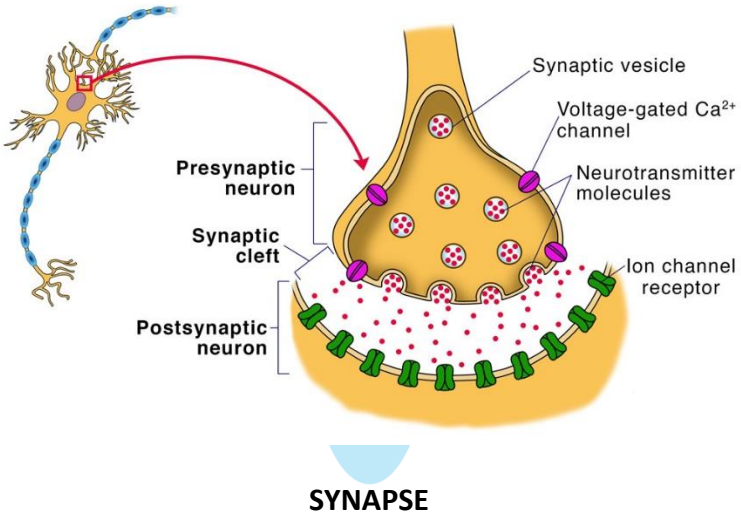
(3) Electrical current can flow directly from one neuron into the other across the electrical synapse.

(4) Chemical synapses use neurotransmitters

Answer (1)

Explanation:

Synapses refer to the points of contact between neurons where information is passed from one neuron to the next. Synapses most often form between axons and dendrites, and consist of a presynaptic neuron, synaptic cleft, and a postsynaptic neuron.



SYNAPSE

At a chemical synapse, the membranes of the pre and post synaptic neurons are seprated by a fluid filled space called the synaptic cleft. Chemicals called neurotransmitters are involved in the transmission of impulses at these synapses. The terminals of the axon end into a bulb like structure and these bulbs have chemical in them known as the neurotransmitter. So when an impulse arrives at the axonal end it stimulates the movements of theses synaptic vesicles towards the membrane, where they fuse with the plasma membrane and release these neurotransmitters in the synaptic cleft. And this is known as chemical synapse. Impulse transmission across an electrical synapse is always faster than that across a chemical synapse. Electrical synapses are rare in our system. At electrical synapse the membranes of pre and post synaptic neurons are in close proximity

Chapter Name: Neural Control and Co-ordination.

188. 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) (c), (d) and (e) only
(2) (a), (b) and (d) only
(3) (b) only
(4) (c) and (d) only

Answer (3)

Explanation:

The first human hormone produced by recombinant DNA technology is **insulin**. It was humulin . In 1982 Food and Drug Administration approved **Humulin, Eli Lily's recombinant insulin**. It has A-peptide and B-peptide chains of insulin are produced separately in *E.coli,* extracted and combined by creating disulphide bond between them.

In option a) Pro-hormone insulin contain extra stretch of C-peptide, this statement holds true for natural insulin and not genetically engineered insulin. In humans, insulin is synthesised as pro-hormone which needs to be processed before it becomes a fully mature and functional hormone. It contains an extra stretch called the C peptide which is removed during maturation into insulin. Statement (c) is incorrect as insulin obtained from cattles and pigs is not genetically engineered insulin. Statement (d) is incorrect because conversion of pro-insulin to insulin is not required during production of insulin by genetic engineering as A-peptide and B-peptide chains are produced separately. Statement (e) is incorrect as allergic reactions to insulin are mostly seen when the insulin is obtained from animals

Chapter Name: Biotechnology and its Applications

189. Which of the following are not the effects of Parathyroid hormone?

(a) Stimulates the process of bone resorption
(b) Decreases Ca2+ level in blood

(c) Reabsorption of Ca2+ by renal tubules
(d) Decreases the absorption of Ca2+ from digested food
(e) Increases metabolism of carbohydrates

Choose the most appropriate answer from the options given below:

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

Answer (3)

Explanation:

Parathyroid hormone (PTH) is a hormone your parathyroid glands release to control calcium levels in your blood. It also controls phosphorus and vitamin D levels. If your body has too much or too little parathyroid hormone, it can cause symptoms related to abnormal blood calcium levels. Parathyroid hormone (PTH) increases the Ca2+levels in the blood. PTH acts on bones and stimulates the process of bone resorption thereby increasing the blood calcium levels. PHT increases the absorption of Ca2+ from digested food. Insulin is the key hormone of carbohydrate metabolism, it also influences the metabolism of fat and proteins. It lowers blood glucose by increasing glucose transport in muscle and adipose tissue and stimulates the synthesis of glycogen, fat, and protein.

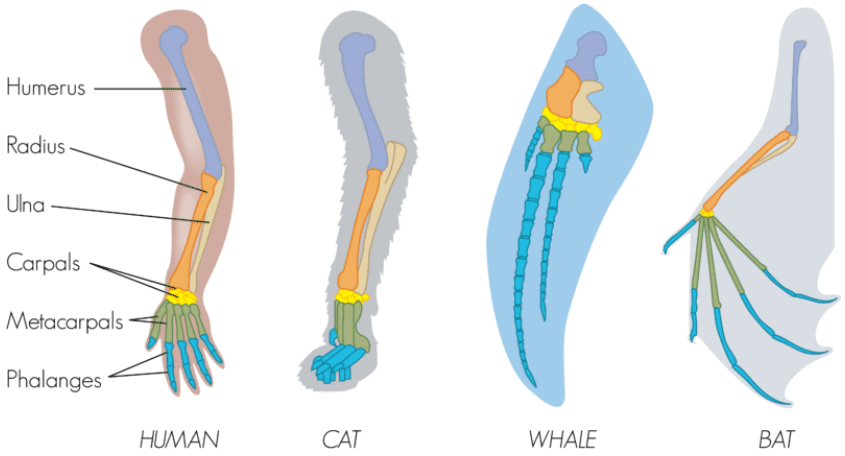
Chapter Name: Chemical Control and Co-ordination

190. Which of the following statements is not true?
(1) Flippers of penguins and dolphins are a pair of homologous organs
(2) Analogous structures are a result of convergent evolution
(3) Sweet potato and potato is an example of analogy
(4) Homology indicates common ancestry

Answer (1)

Explanation:

The Option 1 is the correct answer because flippers of penguins and dolphins are analogous organs as they don't not have the same structure but both of these perform the same function. Hence, called as analogous structures. Homologous structures are structures that look alike but perform different function.



HOMOLOGOUS STRUCTURES

Analogous structures are a result of convergent evolution, Potato and sweet potato are examples of analogous organs. Both sweet potato and potato have a common function i.e., storage of food in the form of starch.hence option 3 is also a correct statement. Homologous organs have the same structure but have different functions according to the needs of the organisms. Hence, homology indicates common ancestry. Analogous structures have developed for the same function but do not show a similarity in structure. Hence, they are a result of convergent evolution..

Chapter Name: Human Evolution.

191. Which one of the following statements is correct?

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

Answer (4)

Explanation:

Joint diastole occurs when the heart's **four chambers are all relaxed**. As a result, the heart's ventricles and atria are in a state of relaxation. Venous blood flows into the auricles during joint diastole. During joint diastole, **blood moves freely** from **atrium to ventricle** as atrioventricular valve remain open during joint diastole. Option 1 is incorrect because decrease in ventricular pressure, during ventricular diastole closes semilunar valves to produce ‘dub’ heart sound and not during increased ventricular pressure. Option 2 is incorrect because SA node generates action potential to

stimulate atrial contraction. Option 3 is incorrect because bicuspid and tricuspid valves open due to pressure exerted by blood present in atria and decrease in pressure in ventricles during ventricular diastole and not due to pressure exerted by the simultaneous contraction of the atria.

Chapter Name: Body Fluids and Circulation.

192. 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

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

Answer (1)

Explanation:

Glycogen is a polysaccharide. Glycogen is an easily mobilized storage form of glucose. Almost all of the glucose residues in glycogen are linked by glycosidic bonds. - Glycogen synthesis requires an activated form of glucose

Antibodies are gamma globulins produced by B lymphocytes and these antibodies are involved in antibody formation and immunity production. These antibodies are secreted by a type of WBC (white blood cells), called as a plasma cell and is present in the blood plasma..

The steroid hormones are synthesized in the adrenal cortex, the gonads, and the placenta; are all derived from cholesterol and many are of clinical importance. Steroid hormones are synthesized in the mitochondria and smooth endoplasmic reticulum.

Thrombin is a biocatalyst which converts soluble fibrinogen to insoluble fibrin and as it is a catalyst it is responsible to speed up the rate of the clotting reaction and thus aid in clotting.

Chapter Name: Digestion and Absorption, Body Fluids and Circulation, Excretory Products and their Elimination.

193. Select the incorrect statement with respect to acquired immunity.

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

Answer (1)

Explanation:

Option (1) is the correct answer as acquired immunity is a specific type of defence which is not present at the time of birth and as the name suggests it is Acquired durning the life span of the individual and is not present since birth. Innate immunity is the immunity that is present since birth. Option (2), (3) and (4) are true statements and hence cannot be the answer. Anamnestic response or secondary immune response is a highly intensified response due to memory of first encounter. When our body encounters a pathogen for the first time then the body elicits the primary immune response. When there is a subsequent encounter with the same pathogen, secondary or anamnestic immune response is elicited.

Chapter Name: - Human Health and Disease

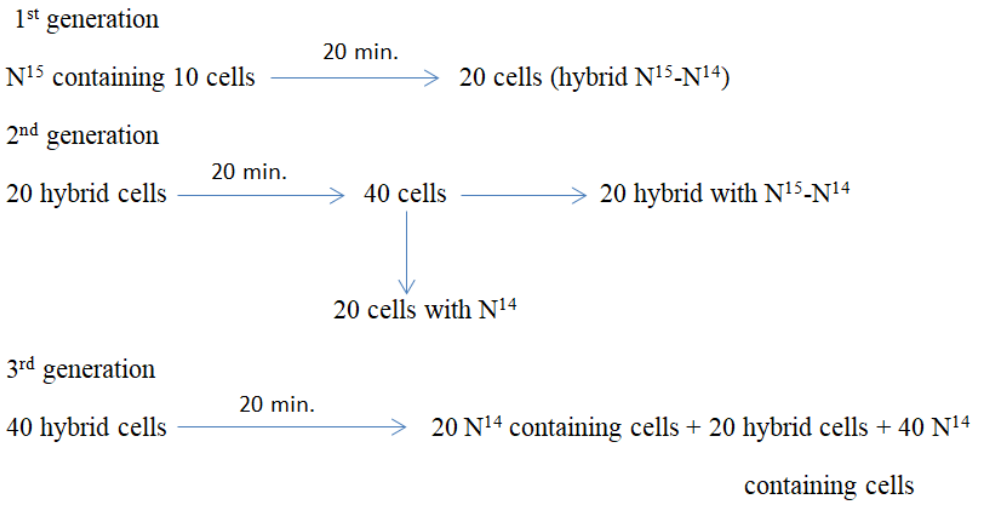
194. Ten E.coli cells with 15N - dsDNA are incubated in medium containing 14N nucleotide. After 60 minutes, how many E.coli cells will have DNA totally free from 15N?

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

Answer (4)

Explanation:

when 10 parent E.coli cells with N^{15} are cultured in medium contains N^{14} nucleotide. N^{14} is incorporated into the newly synthesised DNA. Thus, the DNA that extracted from culture after 1^{st} generation i.e., just after 20 min. have hybrid DNA with N^{14}-N^{15}. Culture from 3^{rd} generation or after 40 min. has equal amount of two types of cells containing DNA with N^{14} and hybrid DNA with N^{14}-N^{15}.



Therefore, after 3rd generation or after 60 minutes (1st generation-20 min,2nd generation-20 min and 3rd generation-20min.) 60 E.coli cells will have DNA totally free from N^{15} i.e., cell containing DNA with N^{14}.

Chapter Name: Molecular Basis of Inheritance

195. Which of the following is a correct statement?

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

Answer (2)

Explanation:

The cyanobacteria have chlorophyll a similar to green plants and are photosynthetic autotrophs. The cyanobacteria are unicellular, colonial or filamentous, fresh-water marine or terrestrial algae. The colonies are generally surrounded by a gelatinous sheath. They often form blooms in polluted water bodies. Some of these organisms can fix atmospheric nitrogen in specialized cells called heterocysts, e.g, Nostoc and Anabaena.

Slime moulds are classified under kingdom Protista. Slime molds are aggregates into colonies and ingest bacteria, fungal spores, and possibly other protists. Once the slime mold cells group, they do one of two things: Either they fuse their individual cells into one massive multi-nucleated cell, or they fuse their membranes to one another to form a cluster of individual cells.

Mycoplasma is the single-celled prokaryotic organism. This organism lacks the cell wall and possesses the cell membrane. The organism have been evolved from the Gram-positive bacteria.

Bacteria can be autotrophic as well as heterotrophic.

Chapter Name: Biological Classification

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

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

Answer (1)

Explanation:

1% recombination frequency = 1 centi Morgan

To place the genes on a linear chromosome, decreasing order of recombination frequency will be considered.

Since recombination frequency is directly proportional to the distance between genes, the values are used to locate genes on a chromosome. Here four genes a, b, c and d can assume any of four linear sequences:

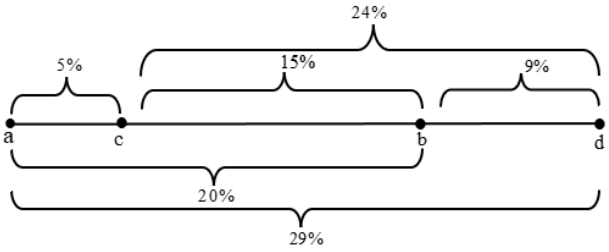
a, c, b, d,

a, d, b, c,

d, b, a, c

a, b, c, d.

which depends on the genes present in the middle. Here, recombination frequency for genes a & c is 5%, b & c is 15%, b & d is 9%, a & b is 20%, c & d is 24% and a & d is 29% which means that genes a and d are present at extremes and c-b lie in middle, Thus, the sequence of genes is a- c- b-d.



Sequence of genes

Chapter Name – Principles of Inheritance and Variation

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

Answer (3)

Explanation:

Diaphragms are barrier methods of contraception. It fits inside the vagina and covers the cervix to block the entry of sperms into the uterus.

Contraceptive pills are the oral pill containing either progesterone alone or combination of progesterone and oestrogen. They inhibit ovulation and implantation as well as change the cervical mucus to prevent entry of sperms.

Intra uterine devices increase the phagocytosis of sperms within the uterus.

Lactational amenorrhoea is a natural method of contraception. It is based on the fact of absence of menstrual cycle and therefore ovulation does not occur during the period of intense lactation following parturition.

Thus, the correct answer is option 3.

Chapter Name: Reproductive Health

198. Match List-I with List-II

List-I		List-II	
(a)	Bronchioles	(i)	Dense Regular Connective Tissue
(b)	Goblet cell	(ii)	Loose Connective Tissue
(c)	Tendons	(iii)	Glandular Tissue
(d)	Adipose Tissue	(iv)	Ciliated Epithelium

Choose the correct answer from the options given below:

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

Answer (2)

Explanation:

If columnar or cuboidal cell bear hair like projection on the surface are called as ciliated epithelium. Ciliated cuboidal epithelium is mainly present in the inner surface of bronchioles and ciliated columnar epithelium occurs in the inner surface of fallopian tubes. The function is to move particles or mucus in a specific direction over the epithelium.

Some of the columnar or cuboidal cells get specialised for secretion of and are called glandular epithelium. Based on the number of cells, it is of two types unicellular gland and multicellular gland. Goblet cells are unicellular glands. It is specialised to secrete mucus.

Tendons are dense regular connective tissues because it has parallel bundles of collagen fibres. They attach skeletal muscles to bones.

Adipose tissue is a type of loose connective because it has loosely arranged adocytes, white and yellow fibres. It is mainly present beneath the skin. The cells of this tissue are specialised to store fats.

Thus, the correct answer is option 2.

Chapter name: Structural Organization in Animals

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

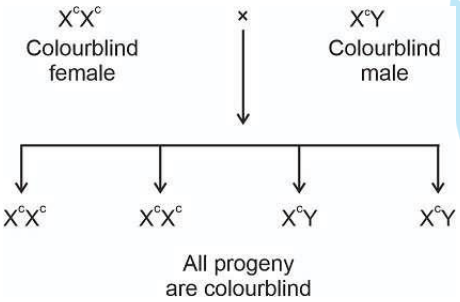
(1) 100%
(2) 25%
(3) 50%
(4) 75%

Answer (1)

Explanation:

Colour Blidness is a sex-linked recessive disorder due to defect in either red or green cone of eye resulting in failure to discriminate between red and green colour. This defect is due to mutation in certain genes present in the X chromosome. It occurs in about 8 per cent of males and only about 0.4 per cent of females. This is because the genes that lead to red-green colour blindness are on the X chromosome. Males have only one X chromosome and females have two. The son of a woman who carries the gene has a 50 per cent chance of being colour blind. The mother is not herself colour blind because the gene is recessive. That means that its effect is suppressed by her matching dominant normal gene. A daughter will not normally be colour blind, unless her mother is a carrier and her father is colour blind.

If mother of man is colourblind, then man will also be colourblind as colour blindness is a X-linked recessive trait and shows criss-cross inheritance.



Chapter Name – Principles of Inheritance and Variation

200. Given below are two statements:

Statements 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) cannot 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) Statement I is incorrect but Statement II is correct
(2) Both Statement I and Statement II are correct
(3) Both Statement I and Statement II are incorrect
(4) Statement I is correct but Statement II is incorrect

Answer (1)

Explanation:

Electrostatic precipitator is the most efficient device to remove fine particulate pollutants. It is Electrostatic precipitation devices that works on the principle of electrical charging of dust particles and collecting it on a differently charged platform and not scrubber.

Electrostatic precipitator can remove over 99 per cent particulate matter present in the exhaust from a thermal power plant. It has electrode wires that are maintained at several thousand volts, which produce a corona that releases electrons. These electrons attach to dust particles giving them a net negative charge. The collecting plates are grounded and attract the charged dust particles. A scrubber can remove gases like sulphur dioxide. In a scrubber, the exhaust is passed through a spray of water or lime. Particulate size 2.5 micrometers or less in diameter (PM 2.5) are responsible for causing the greatest harm to human health. These fine particulates can be inhaled deep into the lungs and can cause breathing and respiratory symptoms, irritation, inflammations and damage to the lungs and premature deaths. Particulate size 2.5 micrometers or less in diameter (PM 2.5) can be removed very efficiently by the help of a electrostatic precipitator.

Thus, **Statement I** is incorrect but **Statement II** is correct.

Chapter Name – Environmental Issues