NEET-UG EXAMINATION PAPER-2022

(Solved)

Time allowed : 3 hours | Maximum Marks : 802

General Instructions :

Read the following instructions carefully and follow them :

i. This question paper contains **200 questions.** All questions are **compulsory.**

ii. This question paper is divided into **1 sections.**

iii. **Section A** – questions number **1 to 200** are multiple choice questions

iv. There is no overall choice given in the question paper. However, an internal choice has been provided in few questions.

v. Use of calculator is NOT allowed.

Section A

Question 1.

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

[4 Marks]

(A) 3.22kg-m2

(B) 30.8 kg-m2

(C) 0.7kg-m2

(D) 0.07 kg-m2

Explanation:

Given: ω_i = 60 rpm = 60 × (2π/60) = 2π rad / s

$\omega_f = 360 \text{ rpm} = 360 \times (2\pi/60) = 12\pi \text{ rad / s}$

Energy spent, $\Delta KE = 484$ J

Energy spent, $\Delta KE = \frac{1}{2} I (\omega_f^2 - \omega_i^2)$ where

I = moment of inertia

$486 = 1/2 \times I [(12\pi)^2 - (2\pi)^2]$

$\therefore I = (2 \times 486)/(140\pi^2) \approx 0.7 \text{ kg-m}^2$

Question 2.

Let R_1 be the radius of the second stationary and R_2 be the radius of the fourth stationary orbit of an electron in Bohr's model. The ratio R_1/R_2 is:

[4 Marks]

(A) 0.5

(B) 0.25

(C) 4

(D) 2

Explanation:

Radius, $R = 0.529 \times (n^2/Z)$ Å $\therefore R_1/R_2 = 2^2/4^2 = 1/4 = 0.25$

Question 3.

During a cloudy day, a primary and a secondary rainbow may be created, then the:

[4 Marks]

(A) secondary rainbow is due to double internal reflection and is formed above the primary one.

(B) primary rainbow is due to double internal reflection and is formed above the secondary one.

(C) primary rainbow is due to double internal reflection and is formed below the secondary one.

(D) secondary rainbow is due to single reflection and is formed above the primary one.

Explanation:

When light rays undergo two internal reflections inside a raindrop, instead of one as in the primary rainbow, a secondary rainbow is formed. The secondary rainbow forms above the primary rainbow.

Question 4.

The reciprocal of resistance is:

[4 Marks]

(A) conductivity

(B) mobility

(C) conductance

(D) reactance

Explanation:

Resistance offers obstruction to current while conductance allows electric current to flow, so conductance is the reciprocal of resistance.

Question 5.

Two copper vessels A and B have the same base area but of different shapes. A take twice the volume of water as that B requires to fill upto a particular common height. Then the correct statement among the following is:

[4 Marks]

(A) Both vessels A and B weigh the same.

(B) Pressure on the base area of A and B is not same.

(C) Vessel B weighs twice that of A.

(D) Pressure on the base area of vessels A and B is same.

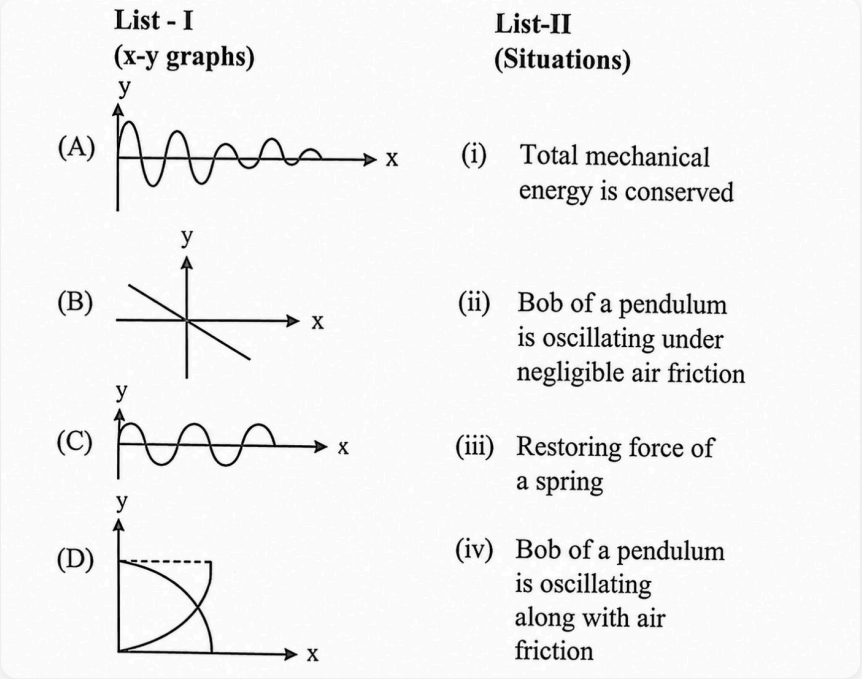
Explanation:

Pressure, P = hρg. Since water is filled upto the same height so pressure at the bottom will be the same.

Question 6.

Match List - I with List - II: Choose the correct answer from the options given below:

[4 Marks]



(A) (A)-(iii), (B) - (ii), (C) - (i), (D) - (iv)

(B) (A) (iv), (B) - (ii), (C) - (iii), (D) - (i)

(C) (A)- (iv), (B) - (iii), (C) - (ii), (D) - (i)

(D) (A)- (i), (B) - (iv), (C) - (iii), (D) - (ii)

Explanation:

Graph (a) represents damped oscillation bob of a pendulum oscillating along with air friction. Graph (b) represents restoring force of spring F = -kx.

Graph (c) represents undamped oscillations of a pendulum oscillating under negligible air friction. Graph (d) represents total mechanical energy conservation.

Question 7.

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

[4 Marks]

(A) 30 m

(B) 300 m

(C) 0.3 m

(D) 3 m

Explanation:

Given P = 0.3 kg m/s, mass m = 5 g = 5/1000 kg, t = 5 s, S = ? P = mv. 0.3 = (5/1000) × v ⇒ v = 60 m/s. Distance travelled in 5 s = v × t = 60 × 5 = 300 m.

Question 8.

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

[4 Marks]

(A) C/2

(B) 4 C

(C) 2 C

(D) C/4

Explanation:

Given: A' = A/2 and d'=2dCapacitance $C = A\varepsilon_0/d \therefore C' = (A/2)\varepsilon_0 / (2d) = C/4$.

Question 9.

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

[4 Marks]

(A) 10-3T

(B) 102 T

(C) 10-1 T

(D) 10-2 T

Explanation:

Magnetic field at the centre of the coil

$B = \mu_0 nI / 2R$

$= (4\pi \times 10^{-7} \times 1000 \times 1) / (2 \times 62.8 \times 10^{-2}) = 10^{-3}$ T.

Question 10.

The magnetic field of a plane electromagnetic wave is given by □□ = 3×10^{-8} cos(1.6×10^{3}x + 48×10^{10}t) ĵ, then the associated electric field will be:

[4 Marks]

(A) 3×10^{-8} sin(1.6×10^{3}x + 48×10^{10}t) î V/m

(B) 3×10^{-8} cos(1.6×10^{3}x + 48×10^{10}t) î V/m

(C) 9 sin(1.6×10^{3}x - 48×10^{10}t) k̂ V/m

(D) 9 cos(1.6×10^{3}x + 48×10^{10}t) k̂ V/m

Explanation:

From given equation $B_0 = 3\times10^{-8}$ V/m. $E_0/B_0 = c \Rightarrow E_0 = B_0c = 3\times10^{-8} \times 3\times10^{8} = 9$ V/m. Phase of magnetic and electric field is same for a travelling EM wave. $\hat{E} = \hat{B} \times \hat{c} = \hat{j} \times (-\hat{i}) = \hat{k}$. $\therefore \vec{E} = 9$ cos(1.6×10^{3}x + 48×10^{10}t) k̂ V/m.

Question 11.

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

[4 Marks]

(A)



(B)



(C)



(D)



Explanation:

Graph (a) represents restoring force of a spring, F = -kx

Question 12.

A cricket ball is thrown by a player at a speed of 20 m/s in a direction 30° above the horizontal. The maximum height attained by the ball during its motion is. ($g = 10\ m/s^2$)

[4 Marks]

(A) 5 m

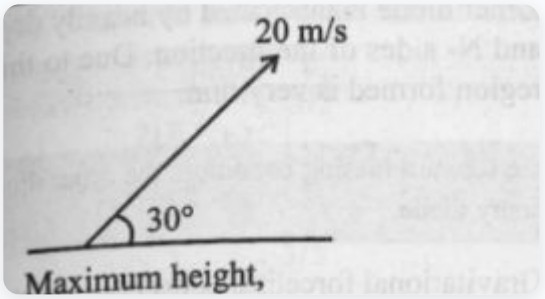
(B) 25 m

(C) 20 m

(D) 10 m

Explanation:

$H = u^2 \sin^2\theta / 2g = (20)^2 \times (1/2)^2 / (2 \times 10) = 5$ m.



Question 13.

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

[4 Marks]

(A) 0.375 V

(B) 3.75 V

(C) 4 V

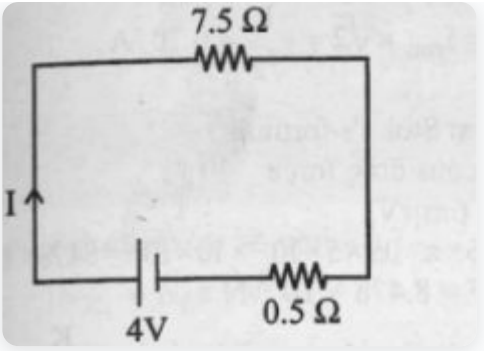
(D) 4.25 V

Explanation:

Current $I = V / (R + r) = 4 / (7.5 + 0.5) = 0.5$ A.

Terminal voltage $V = E - ir =$

$4 - 0.5 \times 0.5 = 3.75$ V.



Question 14.

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

[4 Marks]

(A) If $V_2 > V_1$ then $T_2 < T_1$

(B) If $V_2 > V_1$ then $T_2 > T_1$

(C) If $P_1 > P_2$ then $T_1 < T_2$

(D) If $P_1 > P_2$ then $V_1 > V_2$

Explanation:

Given, $PV^2 = C \Rightarrow TV = \text{const}$ and $T^2/P = \text{const}$ $P \uparrow \Rightarrow V \downarrow T \uparrow \Rightarrow V \downarrow T \uparrow = P \uparrow P_1 > P_2 \Rightarrow V_2 > V_1$ $V_2 > V_1 \Rightarrow T_1 > T_2$ $P_1 > P_2 = T_1 > T_2$

Question 15.

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

[4 Marks]

(A) a plane

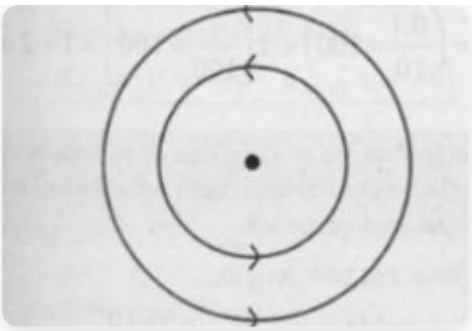
(B) elliptical

(C) circular

(D) a straight line

Explanation:

For an infinite long current carrying conductor, magnetic field lines are concentric circles.



Question 16.

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

[4 Marks]

(A) 1.1 V

(B) 6.4 V

(C) 2 V

(D) 2 eV

Explanation:

By Einstein's photoelectric equation $h\nu = W + eV_s$. $4.2\ eV = 2.2\ eV + e \times V_s \Rightarrow 2\ eV = eV_s \Rightarrow 2 \times 1.6 \times 10^{-19} = 1.6 \times 10^{-19} \times V_s \therefore V_s = 2v$

Question 17.

Identify the function which represents a non periodic motion.

[4 Marks]

(A) sin ωt

(B) sin ωt + cos ωt

(C) e-wt

(D) sin(ωt + π/4)

Explanation:

Periodic motion is represented by sine & cosine (harmonic functions). So e^{-wt} is not a harmonic function.

Question 18.

An inductor of inductance 2 mH is connected to a 220 V, 50 Hz a.c. source. Let the inductive reactance in the circuit is X_1. If a 220 V dc source replaces the ac source in the circuit, then the inductive reactance in the circuit is X_2. X_1 and X_2 respectively are:

[4 Marks]

(A) 0.628 W, zero

(B) 6.28 W, infinity

(C) 6.28 W, zero

(D) 0.628 W, infinity

Explanation:

When A.C. source is applied $X_1 = \omega L = 2\pi fL = 2\pi \times 50 \times 2 \times 10^{-3} = 0.628\ \Omega$. And when D.C. source is applied $X_2 = \omega L = 2\pi fL = 0$ ($\because f = 0$)

Question 19.

The ratio of the magnitude of the magnetic field and electric field intensity of a plane electromagnetic wave in free space of permeability μ_0 and permittivity ε_0 is (Given that C=velocity of light in free space):

[4 Marks]

(A) $c / \sqrt{(\mu_0\varepsilon_0)}$

(B) 1/c

(C) $\sqrt{(\mu_0\varepsilon_0)} / c$

(D) c

Explanation:

We know $|E| = c|B| \Rightarrow |B|/|E| = 1/c$.

Question 20.

The threshold frequency of a photoelectric metal is ν_0. If light of frequency $4\nu_0$ is incident on this metal, then the maximum kinetic energy of emitted electrons will be

[4 Marks]

(A) 4 hn0

(B) 2 hn0

(C) hn0

(D) 3 hn0

Explanation:

By photoelectric equation $h\nu = h\nu_0 + K.E_{max}$

$h \times 4\nu_0 = h\nu_0 + K.E_{max}$ ($\because \nu = 4\nu_0$)

$h \times 4\nu_0 = h\nu_0 + K.E_{max} \therefore K.E.max = 4h\nu_0 - h\nu_0 = 3h\nu_0$.

Question 21.

Given below are two statements one is labelled as Assertion (A) and the other is labelled as Reason (R). Assertion (A): When a fire cracker (rocket) explodes in mid air, its fragments fly in such a way that they continue moving in the same path, which the fire cracker would have followed, had it not exploded. Reason (R): Explosion of cracker (rocket) occurs due to internal forces only and no external force acts for this explosion.

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

[4 Marks]

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

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

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

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

Explanation:

Centre of mass, CoM of the rocket follows the same path not the fragments. It is because the explosion takes place due to internal forces.

Question 22.

Given below are two statements.

Statement I: In an ac circuit, the current through a capacitor leads the voltage across it.

Statement II: In ac circuits containing pure capacitance only, the phase difference between the current and the voltage is π.

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

[4 Marks]

(A) Statement I is incorrect but Statement II is correct

(B) Statement I is correct but Statement II is incorrect

(C) Both Statement 1 and Statement II are correct

(D) Both Statement 1 and Statement II are incorrect

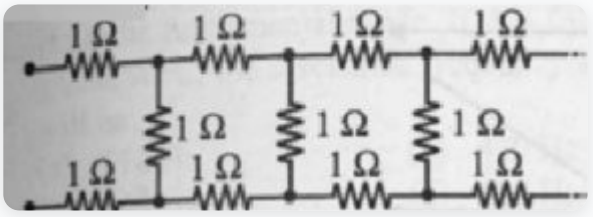
Explanation:

In an AC circuit, current through the capacitor leads the potential difference across it by a phase of π/2, not π.

Question 23.

The equivalent resistance of the infinite network given below is :

[4 Marks]



(A) (1 + √3) Ω

(B) (1 + √5) Ω

(C) 2 W

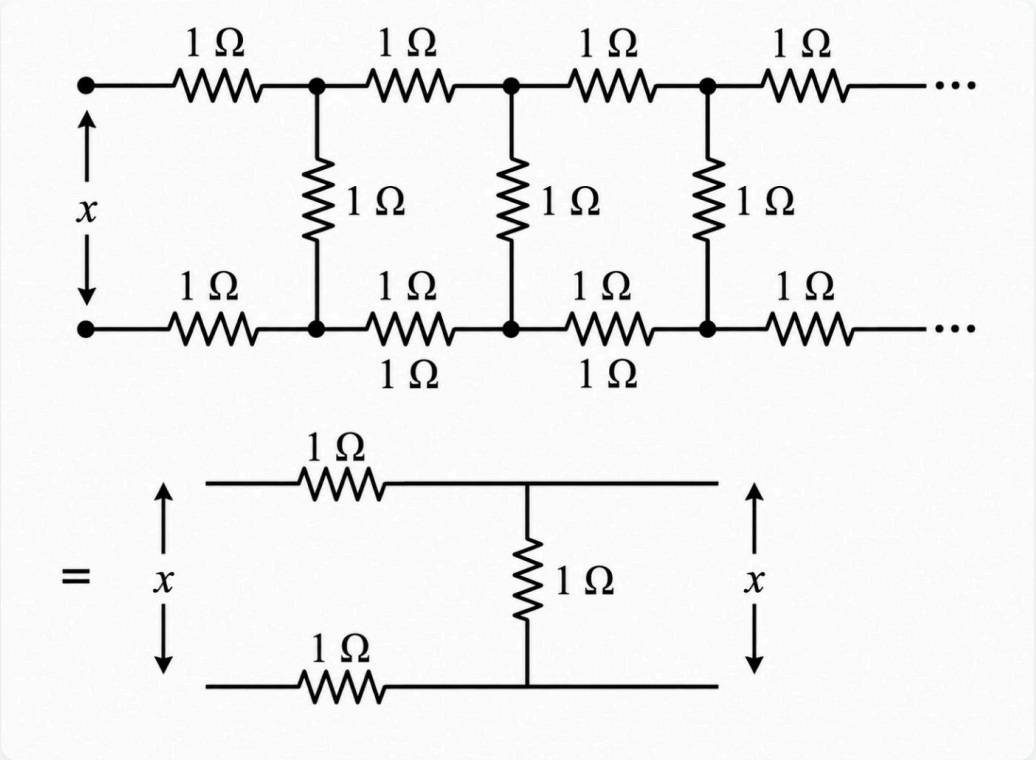
(D) (1 + √2) Ω

Explanation:

By removing the repeated part of the circuit, $\Rightarrow (x \times 1)/(x + 1) + 2 = x \Rightarrow x^2 - 2x - 2 = 0$

$\Rightarrow x = (2 \pm 2\sqrt{3})/2$

$\therefore x = 1 + \sqrt{3}$



Question 24.

If □□ = 2î + ĵ - k̂ and □□ = 3î + 2ĵ - 2k̂ then the scalar and vector products of □□ and□□ have the magnitudes respectively as:

[4 Marks]

(A) 4, √5

(B) 10, √2

(C) 10, 2

(D) 5, √3

Explanation:

Given □□ = 2î + ĵ - k̂, □□ = 3î + 2ĵ - 2k̂,

Scalar product = □□ · □□ = (2î + ĵ - k̂) · (3î + 2ĵ - 2k̂)

= 2 × 3 + 1 × 2 + (-1) × (-2) = 6 + 2 + 2 = 10

Vector product = □□ × □□

| î ĵ k̂ |

| 2 1 -1 |

|3 2 -2|

= î(-2 + 2) - ĵ(-4 + 3) + k̂(4 - 3)

□□ × □□ = ĵ + k̂ ∴ |□□ × □□| = √2

Question 25.

Given below are two statements:

Statement I: The law of radioactive decay states that the number of nuclei undergoing the decay per unit time is inversely proportional to the total number of nuclei in the sample.

Statement II: The half life of a radionuclide is the sum of the life time of all nuclei, divided by the initial concentration of the nuclei at time t = 0.

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

[4 Marks]

(A) Statement I is correct but Statement II is incorrect

(B) Both Statement 1 and Statement II are correct

(C) Both Statement I and Statement II are incorrect

(D) Statement I is incorrect but Statement II is correct

Explanation:

According to the Radioactive decay law, -dN/dt ∝ N.

So the number of nuclei undergoing decay per unit time is directly proportional to the total number of nuclei.

Half life (t_½) is the duration in which half of the active nuclei decayed. Both statements are incorrect.

Question 26.

The physical quantity that has the same dimensional formula as pressure is:

[4 Marks]

(A) Coefficient of viscosity

(B) Force

(C) Momentum

(D) Young's modulus of elasticity

Explanation:

Pressure = F/A and Young's modulus Y = Stress/Strain = $(F/A)/(\Delta l/l_0)$. Hence the dimensions of pressure and Young's modulus (Y) are the same.

Question 27.

The effective capacitances of two capacitors are 3 μF and 16 μF, when they are connected in series and parallel respectively. The capacitance of two capacitors are:

[4 Marks]

(A) 12 μF, 4 μF

(B) 8 μF, 8 μF

(C) 10 mF, 6mF

(D) 1.2 mF, 1.8 mF

Explanation:

In series effective resistance of two capacitors of capacitance C_1 and C_2

$= (C_1C_2) / (C_1 + C_2) = 3\mu F$ ...(i)

In parallel effective resistance, $= C_1 + C_2 = 16\ \mu F$ ...(ii)

From (i) & (ii) $C_1C_2 = 48\ \mu F$ $(C_1 - C_2)^2 = (C_1 + C_2)^2 - 4C_1\ C_2$

$C_1 - C_2 = 8\ \mu F$ ...(iii)

From (ii) & (iii) we get $\hat{C}_1 = 12\ \mu F$ and $C_2 = 4\ \mu F$

Question 28. After passing through a polariser a linearly polarised light of intensity I is incident on an analyser making an angle of 30° with that of the polariser. The intensity of light emitted from the analyser will be:

[4 Marks]

(A) 2I/3

(B) I/3

(C) I/2

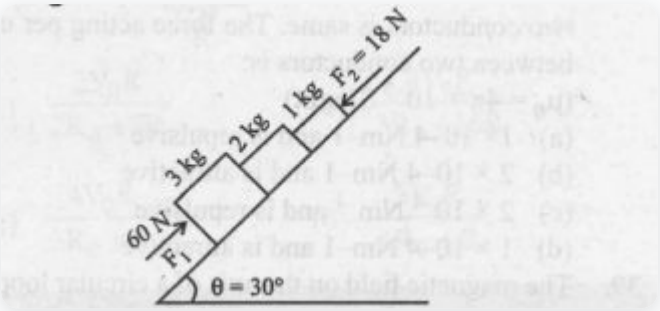
(D) 3I/4

Explanation: By law of Malus, Intensity $I' = I\cos^2\theta = I\cos^2(30°) = I \times (3/4) = 3I/4$.

Question 29.

In the diagram shown, the normal reaction force between 2 kg and 1 kg is (Consider the surface, to be smooth): Given g = 10 ms^{-2}

[4 Marks]



(A) 25 N

(B) 10 N

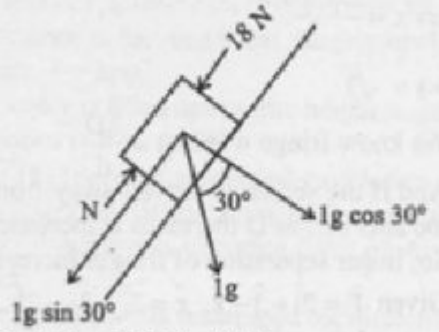
(C) 39 N

(D) 6 N

Explanation:

$$a = \frac{\text{Net pulling force}}{M_{total}} \text{(up the inclined)}$$

$$a = \frac{60 - 18 - (3+2+1)g\sin 30°}{3+2+1} = \frac{12}{6} = 2\,m/s^2$$



By taking F.B.D. of 1 kg

$$ma = N - 18 - 1 \times 10 \times \frac{1}{2}$$

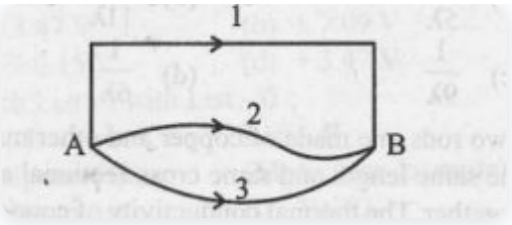
$$\Rightarrow 2 = N - 23$$

$$\Rightarrow N = 25\ N$$

Question 30.

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

[4 Marks]



(A) $W_1 > W_3 > W_2$

(B) $W_1 = W_2 = W_3$

(C) $W_1 > W_2 > W_3$

(D) $W_1 < W_2 < W_3$

Explanation:

Gravitational force is a conservative force and work done by conservative force is path independent, so $W_1 = W_2 = W_3$.

Question 31.

A standard filament lamp consumes 100 W when connected to 200 V ac mains supply. The peak current through the bulb will be:

[4 Marks]

(A) 1.414 A

(B) 1 A

(C) 2 A

(D) 0.707 A

Explanation:

Power, P = Vrms Irms ⇒ Irms = P / Vrms = 1 / 2 Peak current, i_0 = Irms × √2 = 1 / √2 = 0.707 A.

Question 32.

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

[4 Marks]

(A) 8.48 × 10-3 N

(B) 4.23 × 10-3N

(C) 4.23 × 10-6 N

(D) 8.48 × 10-5N

Explanation:

From Stoke's formula,

Viscous drag force F = 6πηrV_t

F = 6 × π × 0.9 × 5×10⁻³ × 10×10⁻² F = 84.78 × 10⁻⁴

F ≈ 8.478 × 10⁻³ N.

Question 33.

In a gravitational field, the gravitational potential is given by V = -K/x (J/kg). The gravitational field intensity at point (2,0,3) m is:

[4 Marks]

(A) +K/2

(B) +K/4

(C) -K/4

(D) -K/2

Explanation:

Gravitational potential, V(x) = -K/x. Gravitational field, E_g = -dV/dx = -d/dx(-K/x) = -K/x² î.

Now |Eˆ_g(2,0,3)| = -K/(2)² = -K/4.

Question 34. The percentage error in the measurement of g is (Given that g = 4π²L/T², L = (10 ± 0.1) cm, T = (100 ± 1) s)

[4 Marks]

(A) 7%

(B) 2%

(C) 5%

(D) 3%

Explanation: Given, g = 4π²L / T² % erroring, (Δg / g) × 100 = (ΔL / L) × 100 + 2(ΔT / T) × 100 = (0.1 / 10 × 100) + 2[1 / 100 × 100] = 1 + 2 = 3%

Question 35.

Two very long, straight, parallel conductors A and B carry current of 5 A and 10 A respectively and are at a distance of 10 cm from each other. The direction of current in two conductors is same. The force acting per unit length between two conductors is: ($\mu_0 = 4\pi \times 10^{-7}$ SI unit)

[4 Marks]

(A) 2×10^{-4} Nm-1 and is repulsive

(B) 1×10^{-4} Nm - 1 and is attractive

(C) 1×10^{-4} Nm-1 and is repulsive

(D) 2×10^{-4} Nm-1 and is attractive

Explanation:

Force per unit length,

$F/l = (\mu_0 i_1 i_2)/(2\pi d) = (2 \times 10^{-7} \times 5 \times 10) / (10 \times 10^{-2}) = 10^{-4}$ N/m. Two parallel wires carrying current in same direction will attract each other.

Question 36.

The magnetic field on the axis of a circular loop of radius 100 cm carrying current I = √2 A at point 1 m away from the centre of the loop is given by:

[4 Marks]

(A) 6.28×10^{-7} T

(B) 3.14×10^{-4} T

(C) 3.14×10^{-7} T

(D) 6.28×10^{-4} T

Explanation:

Magnetic field, on the axis of wire,

$B = (\mu_0 I R^2) / [2(R^2 + x^2)^{(3/2)}]$

$= (4\pi \times 10^{-7} \times \sqrt{2} \times 1^2) / [2(1^2 + 1^2)^{(3/2)}]$

$= (4\pi \times 10^{-7} \times \sqrt{2}) / (2 \times 2\sqrt{2}) = \pi \times 10^{-7}$ T

$\therefore B = 3.14 \times 10^{-7}$ T

Question 37.

At any instant, two elements X_1 and X_2 have same number of radioactive atoms. If the decay constant of X_1 and X_2 are 10λ and λ respectively, then the time when the ratio of their atoms becomes 1/e respectively will be :

[4 Marks]

(A) 1/(11λ)

(B) 1/5 λ

(C) 1/(9λ)

(D) 1/(6λ)

Explanation:

For elements X_1 and X_2

$N_X_1 = N_0 e^{(-\lambda_x t)}$

$N_X_2 = N_0 e^{(-\lambda_y t)}$

$N_X_1 / N_X_2 = e^{[-(\lambda_X_1 - \lambda_X_2)t]}$

$1/e = e^{[-(\lambda_X_1 - \lambda_X_2)t]} \Rightarrow e^{-1}$

$= e^{[-(\lambda_X_1 - \lambda_X_2)t]}$

$(\lambda_X_1 - \lambda_X_2)t = 1$

$t = 1 / (\lambda_X_1 - \lambda_X_2) = 1 / (10\lambda - 1\lambda) = 1 / 9\lambda$

Question 38.

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

[4 Marks]

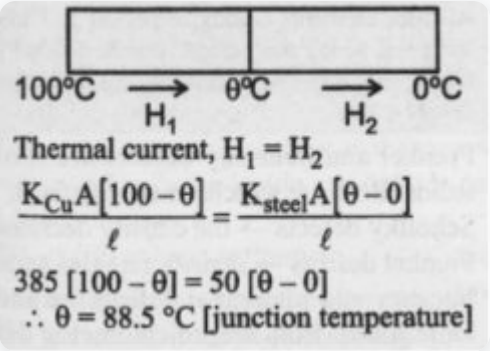
(A) 88.5°C

(B) 73°C

(C) 50°C

(D) 12°C

Explanation:



Question 39.

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

[4 Marks]

(A) 10^{30}

(B) 10^{40}

(C) 10^{20}

(D) 10

Explanation:

Coulomb's force $F_G = Kq_1q_2/r^2$. Gravitational force, $FG = Gm_1m_2/r^2$. $FG/FG = (Kq_1q_2)/r^2$. / $(Gm_1m_2)/r^2$. = $(K/G) \times (1.6\times10^{-19})^2$ / $(1.67\times9.11\times10^{-58})$. $2.4\times10^{39} = (K/G)\ 1.6\times1.6\times10^{-38}$ / $(1.67\times9.11\times10^{-58})$. $K/G \approx 10^{20}$.

Question 40.

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

(A) The distance between the objective and eyepiece is 20.02 m

(B) The magnification of the telescope is (-) 1000

(C) The image of the planet is erect and diminished

(D) The aperture of eye piece is smaller than that of objective. The correct statements are:

[4 Marks]

(A) (A), (B) and (d)

(B) (A), (B) and (C)

(C) (C), (D) and (A)

(D) (B), (C) and (d)

Explanation:

In normal adjustment of an astronomical telescope, the final image is inverted and formed at infinity. Magnification $m = -f_0/fe = -20 / (2\times10^{-2}) = -1000$.

Length of telescope $L = f_0 + fe = 20 + 0.02 = 20.02$. Aperture of eye piece is smaller than that of objective. Statements (A), (B), and (D) are correct.

Question 41.

The magnetic flux linked to a circular coil of radius R is $\phi = 2t^3 + 4t^2 + 2t + 5$ Wb. The magnitude of induced emf in the coil at t = 5 is:

[4 Marks]

(A) 197 V

(B) 150 V

(C) 192 V

(D) 108 V

Explanation:

Given magnetic flux, $\phi = 2t^3 + 4t^2 + 2t + 5$

Induced emf, $e = -d\phi / dt \therefore |e| = | d\phi / dt | = d/dt [2t^3 + 4t^2 + 2t + 5] = 6t^2 + 8t + 2$

$e(t) = 6t^2 + 8t + 2$ $e(t = 5) = 6(5)^2 + 8(5) + 2 = 150 + 40 + 2$

$\therefore |e| = 192$ V

Question 42.

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

[4 Marks]

(A) All vessels contain unequal number of respective molecules

(B) The root mean square speed of helium is the largest

(C) The root mean square speed of molecules is same in all three cases

(D) The root mean square speed of sulfur hexafluoride is the largest

Explanation:

Root mean square speed, v_rms = √(3RT / M) v_rms is independent of degree of freedom. M_Helium is smallest among all given so, v_rms for helium is maximum.

Question 43.

An organ pipe filled with a gas at 27°C resonates at 400 Hz in its fundamental mode. If it is filled with the same gas at 90°C, the resonance frequency at the same mode will be:

[4 Marks]

(A) 484 Hz

(B) 512 Hz

(C) 440 Hz

(D) 420 Hz

Explanation:

Velocity of sound, $V \propto \sqrt{T}$ and $f = V / \lambda \therefore f_1 / f_2 = \sqrt{(T_1 / T_2)}$ $400 / f_2 = \sqrt{[(273 + 27) / (273 + 90)]} = \sqrt{(300 / 363)} = 1 / 1.1 \therefore f_2 = 440$ Hz

Question 44. The collector current in a common base amplifier using n-p-n transistor is 24 mA. If 80% of the electrons released by the emitter is accepted by the collector, then the base current is numerically:

[4 Marks]

(A) 3 mA and entering the base

(B) 6 mA and leaving the base

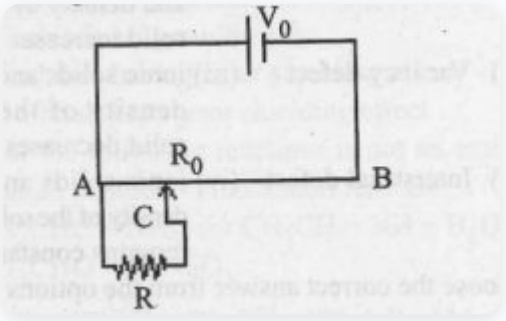
(C) 3 mA and leaving the base

(D) 6 mA and entering the base

Explanation: Since I_E = I_B + I_C Given I_C = 24 mA = 80% of I_E ∴ I_E = 30 mA ∴ I_B = I_E - I_C = 30 - 24 = 6 mA entering the base.

Question 45. The sliding contact C is at one fourth of the length of the potentiometer wire (AB) from A as shown in the circuit diagram. If the resistance of the wire AB is R_0 then the potential drop (V) across the resistor R is

[4 Marks]



(A) $2V_0R / (4R_0 + R)$

(B) $4V_0R / (3R_0 + 16R)$

(C) $4V_0R / (3R_0 + R)$

(D) $2V_0R / (2R_0 + 3R)$

Explanation: Here resistance $R_0/4$ and R are in parallel which is in series with $3R_0/4$ ∴ R_eq = [$(R_0/4) \times R$] / [$(R_0/4) + R$] + $3R_0/4$ = $R_0(16R + 3R_0) / 4(R_0 + 4R)$ And from Ohm's law I = V / R => V = IR ∴ V_R = I [$(R_0/4) \times R$] / [$(R_0/4) + R$] = ($4V_0R / (16R + 3R_0)$)

Question 46.

Match List - I with List - II: Choose the correct answer from the options given below:

[4 Marks]

List - I (quantum number)	List - II (orbital)
(A) $n = 2, \ell = 1$	(i) 2 s
(B) $n = 3, \ell = 2$	(ii) 3 s
(C) $n = 3, \ell = 0$	(iii) 2 p
(D) $n = 2, \ell = 0$	(iv) 3 d

(A) (A)-(iv), (B)-(iii), (C)-(ii), (D)-(i)

(B) (A)-(iii), (B)-(iv), (C)-(i), (D)-(ii)

(C) (A)-(iii), (B)-(iv), (C)-(ii), (D)-(i)

(D) (A)-(iv), (B)-(iii), (C)-(i), (D)-(ii)

Explanation:

l ; 0 1 2 3

subshell : s p d f

∴ n = 2, l = 1 => 2p ; n = 3, l = 2 => 3d ;

n = 3, l = 0 => 3s ; n = 2, l = 0 => 2s

∴ (A) - (iii), (B) - (iv), (C) - (ii), (D) - (i)

Question 47. If the screen is moved away from the plane of the slits in a Young's double slit experiment, then the :

[4 Marks]

(A) linear separation of the fringes decreases

(B) angular separation of the fringes increases

(C) angular separation of the fringes decreases

(D) linear separation of the fringes increases

Explanation: We know fringe width β= λD/d And if the screen is moved away from the plane of the slits i.e., as D increases B increases. So, linear separation of fringes increases.

Question 48.

The density of the solution is 2.15 g mL^{-1}, then mass of 2.5 mL solution in correct significant figures is:

[4 Marks]

(A) 5375 × 10^{-3} g

(B) 5.4 g

(C) 5.38 g

(D) 53.75 g

Explanation:

$$\text{Density}(d) = \frac{\text{Mass}(m)}{\text{Volume}(V)}$$

$$\therefore m = \underbrace{2.15}_{3} \times \underbrace{2.5}_{2} = \underbrace{5.375\ g}_{\text{Must have 2 significant figures.}}$$

3 ↖ Significant figure ; 2 ↗

∴ Mass of the solution = 5.4 g (round - off)

Question 49.

Two half cell reactions are given below.

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

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

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

[4 Marks]

(A) -3.47 V

(B) +7.09 V

(C) +3.47 V

(D) +0.15 V

Explanation:

$E_{Cell} = E_{ox} + E_{red}$

$= E_{Al/Al^{3+}} + E_{Co^{3+}/Co^{2+}}$

= (+1.66 + 1.81) V = +3.47 V

Question 50.

Match List - I with List - II:

Choose the correct answer from the options given below:

[4 Marks]

List - I (Compounds)	List - II (Molecular formula)
(A) Borax	(i) $NaBO_2$
(B) Kernite	(ii) $Na_2B_4O_7 \cdot 4H_2O$
(C) Orthoboric acid	(iii) H_3BO_3
(D) Borax bead	(iv) $Na_2B_4O_7 \cdot 10H_2O$

(A) (A)-(iii), (B)-(i), (C)-(iv), (D)-(ii)

(B) (A)-(i), (B)-(iii), (C)-(iv), (D)-(ii)

(C) (A)-(iv), (B)-(ii), (C)-(iii), (D)-(i)

(D) (A)-(ii), (B)-(iv), (C)-(iii), (D)-(i)

Explanation:

Orthoboric acid : H_3BO_3;

Borax : $Na_2B_4O_7 \cdot 10H_2O$;

Borax Bead : $NaBO_2$;

Kernite : $Na_2B_4O_7 \cdot 4H_2O$

∴ (A) – (iv), (B) – (ii), (C) – (iii), (D) – (i)

Question 51.

The correct order of first ionization enthalpy for the given four elements is:

[4 Marks]

(A) C < N < F < O

(B) C < N < O < F

(C) C < F < N < O

(D) C < O < N < F

Explanation:

Electronic configurations: C → $1s^2\ 2s^2\ 2p^2$;O → $1s^2\ 2s^2\ 2p^4$;

N → $1s^2\ 2s^2\ 2p^3$ (half-filled); F → $1s^2\ 2s^2\ 2p^5$

Question 52.

Match List - I with List - II:

Choose the correct answer from the options given below:

[4 Marks]

List - I (Defects)	List - II (shown by)
(A) Frenkel defect	(i) non-ionic solids and density of the solid decreases
(B) Schottky defect	(ii) non-ionic solids and density of the solid increases
(C) Vacancy defect	(iii) ionic solids and density of the solid decreases
(D) Interstitial defect	(iv) ionic solids and density of the solid remains constant

(A) (A)-(iii), (B)-(iv), (C)-(i), (D)-(ii)

(B) (A)-(i), (B)-(iv), (C)-(ii), (D)-(iii)

(C) (A)-(iv), (B)-(iii), (C)-(i), (D)-(ii)

(D) (A)-(iii), (B)-(i), (C)-(ii), (D)-(iv)

Explanation:

Frenkel and Schottky defects are shown by ionic solids. Both are stoichiometric defects. Schottky defects → the density decreases. Frenkel defects → density remains same. Vacancy and Interstitial defects are shown by non-ionic solids. Both are stoichiometric defects. Vacancy defects → the density decreases. Interstitial defects → the density increases. (A)-(iv), (B)-(iii), (C)-(i), (D)-(ii)

Question 53.

Predict the order of reactivity of the following four isomers towards S_N2 reaction:

(I) $CH_3CH_2CH_2CH_2Cl$

(II) $CH_3CH_2CH(Cl)CH_3$

(III) $(CH_3)_2CHCH_2Cl$

(IV) $(CH_3)_3CCl$

[4 Marks]

(A) (IV) > (II) > (III) > (I)

(B) (I) > (III) > (II) > (IV)

(C) (IV) > (III) > (II) > (I)

(D) (I) > (II) > (III) > (IV)

Explanation:

Reactivity towards S_N2 reaction depends on the following parameters: (i) 1°> 2° > 3° carbon attached to the leaving group.

(ii) Less steric hindrance → more S_N2 reaction. Correct order: (I) > (III) > (II) > (IV).

Question 54.

Match List - I with List - II:

correct answer from the options given below:

[4 Marks]

List - I (molecules)	List - II (shape)
(A) NH_3	(i) square pyramidal
(B) ClF_3	(ii) trigonal bipyramidal
(C) PCl_5	(iii) trigonal pyramidal
(D) BrF_5	(iv) T-shape

(A) (A)-(iv), (B)-(iii), (C)-(i), (D)-(ii)

(B) (A)-(iii), (B)-(iv), (C)-(i), (D)-(ii)

(C) (A)-(ii), (B)-(iii), (C)-(iv), (D)-(i)

(D) (A)-(iii), (B)-(iv), (C)-(ii), (D)-(i)

Explanation:

NH_3 → sp^3 → Trigonal pyramidal.

ClF_3 → sp^3d → T-shape.

PCl_5 → sp^3d Trigonal bipyramidal.

BrF_5 → sp^3d^2 → Square Pyramidal.

Correct matching is (A)-(iii), (B)-(iv), (C)-(ii), (D)-(i).

Question 55.

Which of the following reactions is a part of the large scale industrial preparation of nitric acid?

[4 Marks]

(A)

$$Cu(NO_3)_2 + 2\,NO_2 + 2\,H_2O \xrightarrow[500\,K,\,9\,bar]{Pt} 4HNO_3 + Cu$$

(B)

$$4\,HPO_3 + 2\,N_2O_5 \xrightarrow[500\,K,\,9\,bar]{Pt} 4\,HNO_3 + P_4O_{10}$$

(C)

$$NaNO3 + H2SO4 \xrightarrow[500\,K,\,9\,bar]{Pt} NaHSO_4 + HNO_3$$

(D)

$$4\,NH_3 + 5\,O_2\,(\text{from air}) \xrightarrow[500\,K,\,9\,bar]{Pt} 4\,NO\,6H_2O$$

Explanation:

Large scale industrial preparation of nitric acid = Ostwald Method.

$$4\,NH_3(g) + 5\,O_2(g) \xrightarrow[500K,\,9bar]{Pt/Rh\ gauge\ catalyst} 4\,NO(g) + 6\,H_2O(g)$$

$$2\,NO(g) + O_2(g) \rightleftharpoons 2NO_2(g)$$

$$3\,NO_2(g) + H_2O\,(l) \rightarrow \underset{(68\%\ by\ mass)}{2\,HNO_3(aq)} + \underset{(recycled)}{NO(g)}$$

Question 56.

Match List - I with List - II:

Choose the correct answer from the options given below:

[4 Marks]

	List - I		List - II
(A)	Sodium laurylsulphate	(i)	Toilet soap
(B)	Cetyltrimethyl ammonium chloride	(ii)	Non-ionic detergent
(C)	Sodium stearate	(iii)	Anionic detergent
(D)	Polyethyleneglycyl stearate	(iv)	Cationic detergent

(A) (A)-(iii), (B)-(iv), (C)-(i), (D)-(ii)

(B) (A)-(i), (B)-(iv), (C)-(ii), (D)-(iii)

(C) (A)-(iv), (B)-(iii), (C)-(i), (D)-(ii)

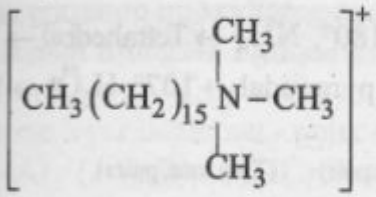
(D) (A)-(iii), (B)-(i), (C)-(ii), (D)-(iv)

Explanation:

Sodium laurylsulphate → $CH_3CH_2)_{10}CH_2OSO_3^-Na^+$

(Anionic detergent)

Cetyltrimethylammonium chloride →



(Cationic detergent)

Sodium stearate → $CH_3(CH_2)_{16}COONa$ → Toilet soap.

Polyethyleneglycyl stearate → $CH_3(CH_2)_{16}COO(CH_2CH_2O)_nCH_2CH_2OH$ → Non-ionic detergent.

(A) - (iii), (B) - (iv), (C) - (i), (D) - (ii)

Question 57. Which among the following is a thermoplastic polymer?

[4 Marks]

(A) Melamine polymer

(B) Bakelite

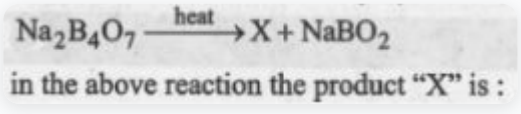
(C) Polythene

(D) Urea-formaldehyde resin

Explanation: Polythene is a thermoplastic polymer. It softens on heating and hardens on cooling.

Question 58.

[4 Marks]



in the above reaction the product "X" is :

(A) B_2O_3

(B) $Na_2B_2O_5$

(C) H_3BO_3

(D) NaB_3O_5

Explanation:

$Na_2B_4O_7 \rightarrow B_2O_3 + 2NaBO_2$.

Boric Sodium

Anhydride metaborate

Question 59. One mole of an ideal gas at 300 K is expanded isothermally from 1 L to 10 L volume. ΔU for this process is: (Use R = 8.314 J K^{-1} mol^{-1})

[4 Marks]

(A) 0 J

(B) 1260 J

(C) 2520 J

(D) 5040 J

Explanation: ΔU = nC_v(ΔT); As this expansion is isothermal, then ΔT = 0; ∴ ΔU = 0.

Question 60.

Match List - I with List - II:

Choose the correct answer from the options given below:

[4 Marks]

	List - I (Complexes)		List - II (Types)
(A)	$[Co(NH_3)_5NO_2]Cl_2$ and $[Co(NH_3)_5ONO]Cl_2$	(i)	ionisation isomerism
(B)	$[Cr(NH_3)_6]$ $[Co(CN)_6]$ and $[Cr(CN)_6]$ $[Co(NH_3)_6]$	(ii)	coordination isomerism
(C)	$[Co(NH_3)_5(SO_4)]Br$ and $[Co(NH_3)_5Br]$ SO_4	(iii)	linkage isomerism
(D)	$[Cr(H_2O)_6]CI_3$ and $[Cr(H_2O)_5Cl]$ $Cl_2 \cdot H_2O$	(iv)	solvate isomerism

(A) (A)-(ii), (B)-(iii), (C)-(iv), (D)-(i)

(B) (A)-(iii), (B)-(ii), (C)-(i), (D)-(iv)

(C) (A)-(iv), (B)-(iii), (C)-(ii), (D)-(i)

(D) (A)-(iii), (B)-(i), (C)-(ii), (D)-(iv)

Explanation:

(A) → (iii) as NO_2 is an ambidentate ligand.

(B) → (ii) as the ligands are exchanged between two coordination spheres.

(C) → (i) ionization isomers as the counter ion gets exchanged between inside and outside coordination sphere.

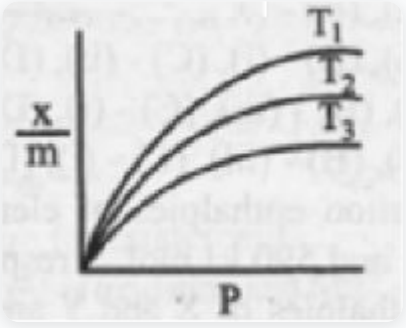
(D) → (iv) solvate isomerism.

Question 61.

Shown below are adsorption isotherms for a gas 'X' at temperatures T_1, T_2 and T_3: p and x/m represent pressure and extend of adsorption, respectively.

The correct order of temperatures for the given adsorption is:

[4 Marks]



(A) $T_1 > T_2 > T_3$

(B) $T_1 = T_2 > T_3$

(C) $T_1 = T_2 = T_3$

(D) $T_3 > T_2 > T_1$

Explanation:

As the temperature increases, the extent of adsorption of a gas on solid surfaces decreases. ∴ $T_3 > T_2 > T_1$.

Question 62.

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

[4 Marks]

(A) 2

(B) 3

(C) 1

(D) 4

Explanation:

$CH_3COOH \rightleftharpoons CH_3COO^- + H^+$. At t_eq C(i-α Cα Cα α = 1% =1/100 = 0.01 ∴ $[H^+]$ = Cα = 0.01 × 10^{-2} = 10^{-4} ∴ pH = -log$[H^+]$ = 4

Question 63.

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

[4 Marks]

(A) 0.08 M

(B) 0.32 M

(C) 0.04 M

(D) 0.16 M

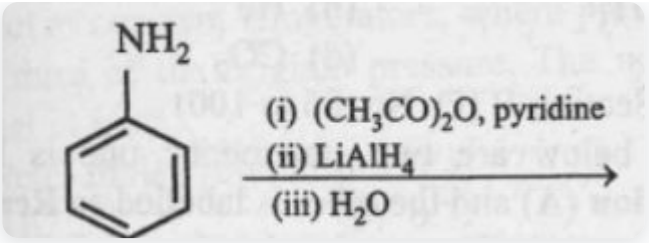
Explanation:

t½ = 2000 yrs Number of half-lives (n) = t / t½ = 8000 / 2000 = 4 ∴ $[A]_0$ / [A]t = 2^n = 2^4 = 16 ∴ $[A]_0$ = 16 × 0.02 = 0.32 M

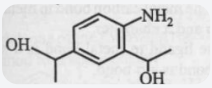
Question 64.

The product formed from the following reaction sequence is:

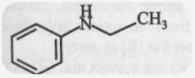
[4 Marks]



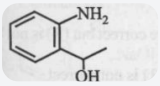
(A)



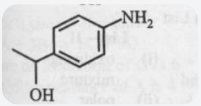
(B)



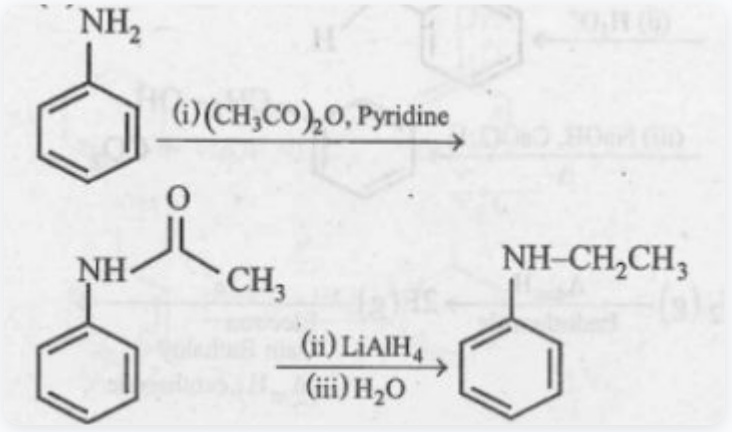
(C)



(D)



Explanation:



Question 65.

The decreasing order of boiling points of the following alkanes is:

(A) heptane

(B) butane

(C) 2-methylbutane

(D) 2-methylpropane

(E) hexane

[4 Marks]

(A) (A) > (C) > (E) > (D) > (B)

(B) (C) > (D) > (A) > (E) > (B)

(C) (A) > (E) > (B) > (C) > (D)

(D) (A) > (E) > (C) > (B) > (D)

Explanation:

Boiling point of alkane $\propto$ Molar mass

$\propto$ Straight chain

$$\propto \frac{1}{\text{Branching}}$$

Heptane: $CH_3CH_2CH_2CH_2CH_2CH_2CH_3 \Rightarrow 100$

Hexane : $CH_3CH_2CH_2CH_2CH_2CH_3 \Rightarrow 86$

2-Methylbutane : $CH_3CH_2\underset{\displaystyle CH_3}{\underset{|}{C}}HCH_3 \Rightarrow 72$

2-Methylpropane : $CH_3-\underset{\displaystyle CH_3}{\underset{|}{C}}H-CH_3 \Rightarrow 58$

Butane : $CH_3\,CH_2\,CH_2\,CH_3 \Rightarrow 58$

Question 66. The element used for welding metals with high melting points is:

[4 Marks]

(A) He

(B) Cl_2

(C) Ne

(D) H_2

Explanation: Atomic hydrogen (produced by dissociation of hydrogen molecule with an electric arc) is allowed to recombine on the surface to be welded to generate a temperature of 4000 K.

Question 67.

Decrease in size from left to right in actinoid series is greater and gradual than that in lanthanoid series due to :

[4 Marks]

(A) 5f orbitals have poor shielding effect

(B) 4f orbitals have greater shielding effect

(C) 4f orbitals are penultimate

(D) 5f orbitals have greater shielding effect

Explanation:

5f orbitals have poor shielding effect

Question 68. $CaCl_2$ and $Ca(OCl)_2$ are components of:

[4 Marks]

(A) lime water

(B) gypsum

(C) Portland cement

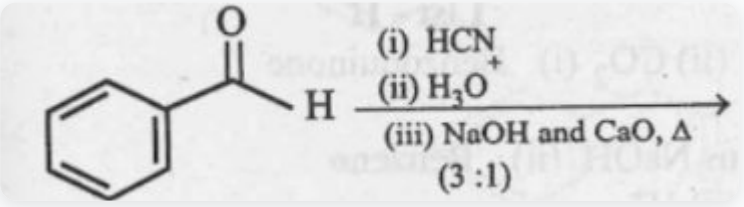
(D) bleaching powder

Explanation: Bleaching powder

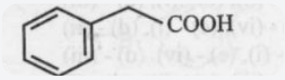
Question 69.

The product formed from the following reaction sequence is:

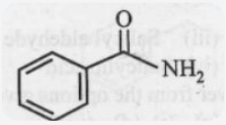
[4 Marks]



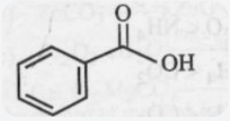
(A)



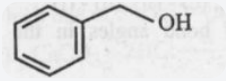
(B)



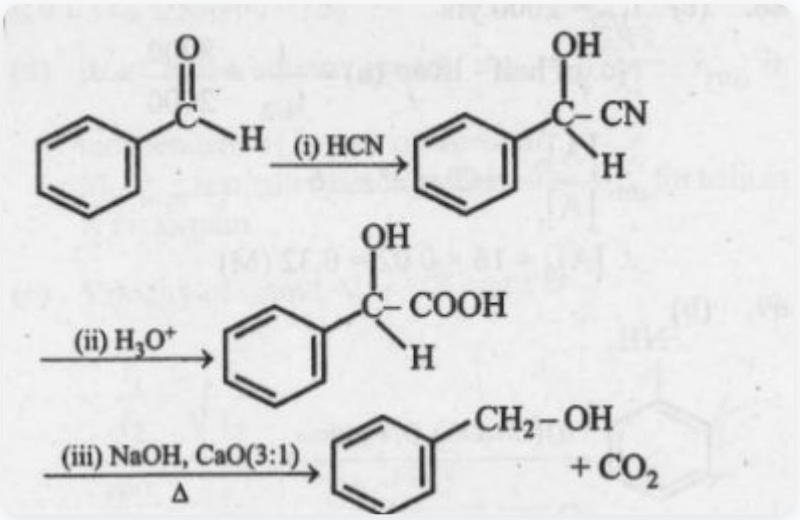
(C)



(D)



Explanation:



Question 70.

Which of the following reactions is a decomposition redox reaction?

[4 Marks]

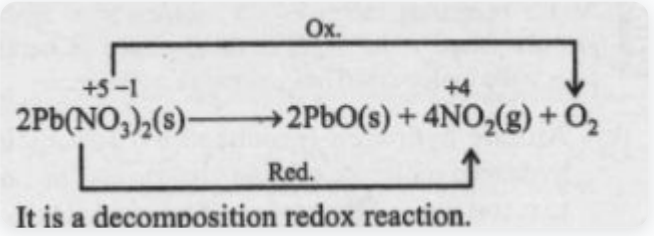
(A) $Cl_2(g) + 2OH^-(aq) \rightarrow ClO^-(aq) + Cl^-(aq) + 4\ H_2O(l)$

(B) $P_4(s) + 3OH^-(aq) + 3H_2O(l) \rightarrow PH_3(g) + 3H_2PO_2^-(aq)$

(C) $2Pb(NO_3)_2(s) \rightarrow 2PbO(s) + 4NO_2(g) + O_2(g)$

(D) $N_2(g) + O_2(g) \rightarrow 2NO(g)$

Explanation:



Question 71.

What is the hybridization shown by C_1 and C_2 carbons, respectively in the given compound? OHC-CH=CH-CH_2COOCH_3

[4 Marks]

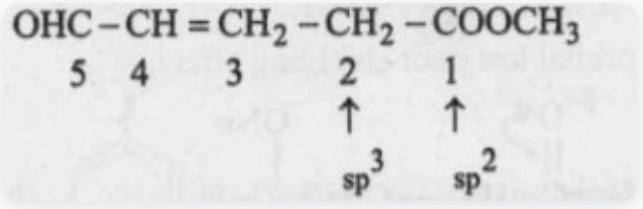
(A) sp^2 and sp^3

(B) sp^2 and sp^2

(C) sp^3 and sp^3

(D) sp^3 and sp^2

Explanation:



Question 72.

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

[4 Marks]

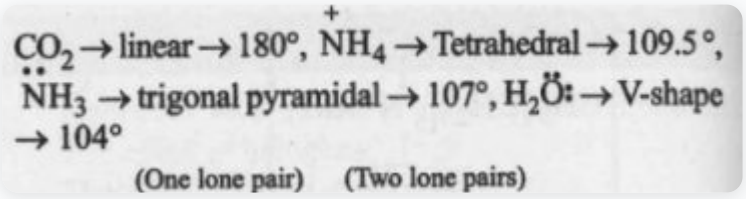
(A) $CO_2 < NH_3 < H_2O < NH_4^+$

(B) $H_2O < NH_3 < NH_4^+ < CO_2$

(C) $H_2O < NH_4^+ < NH_3 < CO_2$

(D) $H_2O < NH_4^+ = NH_3 < CO_2$

Explanation:



Question 73.

Given below are two statements one is labelled as Assertion (A) and the other is labelled as Reason (R). Assertion (A): Chlorine is an electron withdrawing group but it is ortho, para directing in electrophilic aromatic substitution.

Reason (R): Inductive effect of chlorine destabilises the intermediate carbocation formed during the electrophilic substitution, however due to the more pronounced resonance effect, the halogen stabilises the carbocation at ortho and para positions.

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

[4 Marks]

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

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

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

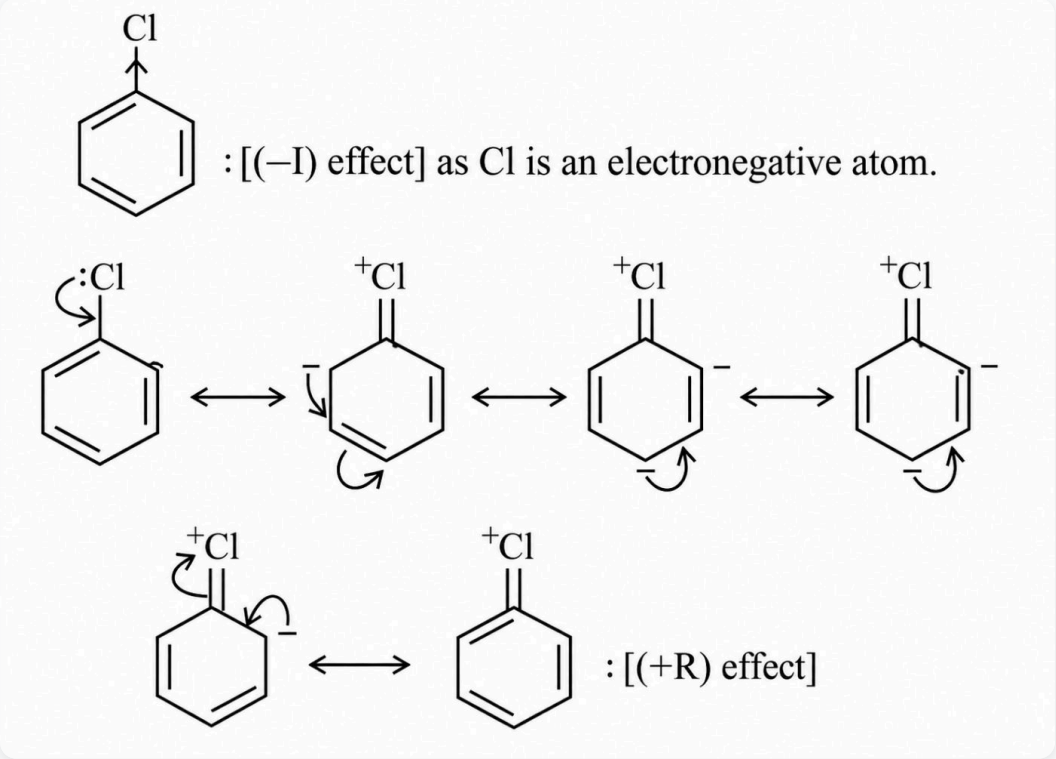
(D) Both (A) and (R) are correct and (R) is the correct explanation of (A).

Explanation:

∴ Electrophilic aromatic substitution is o- and p- directing. Therefore, assertion is correct.

However, — I effect is more pronounced than + R effect of halogens.

Therefore, Reason is not correct.



Question 74.

Match the reagents (List - I) with the product (List - II) obtained from phenol.

Choose the correct answer from the options given below:

[4 Marks]

	List-I		List - II
(a)	(i) NaOH (ii) CO_2 (iii) H^+	(i)	Benzoquinone
(b)	(i) Aqueous NaOH + $CHCl_3$ (ii) H^+	(ii)	Benzene
(c)	Zn dust, Δ	(iii)	Salicyl aldehyde
(d)	$Na_2Cr_2O_7$, H_2SO_4	(iv)	Salicylic acid

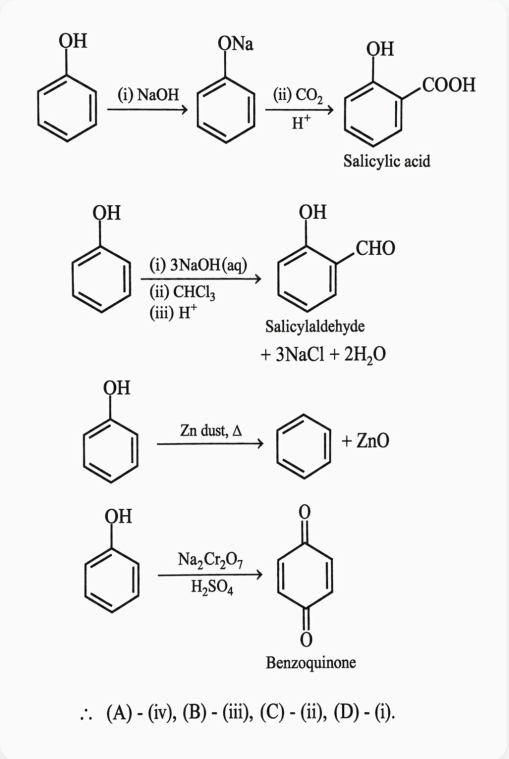
(A) (a)-(ii), (b)-(i), (c)-(iv), (d)-(iii)

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

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

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

Explanation:



∴ (A) - (iv), (B) - (iii), (C) - (ii), (D) - (i).

Question 75.

Match List - I with List-II:

Choose the correct answer from the options given below:

[4 Marks]

List - I (Reaction)	List - II (Product formed)
(A) Gabriel synthesis	(i) Benzaldehyde
(B) Kolbe synthesis	(ii) Ethers
(C) Williamson synthesis	(iii) Primary amines
(D) Etard reaction	(iv) Salicylic acid

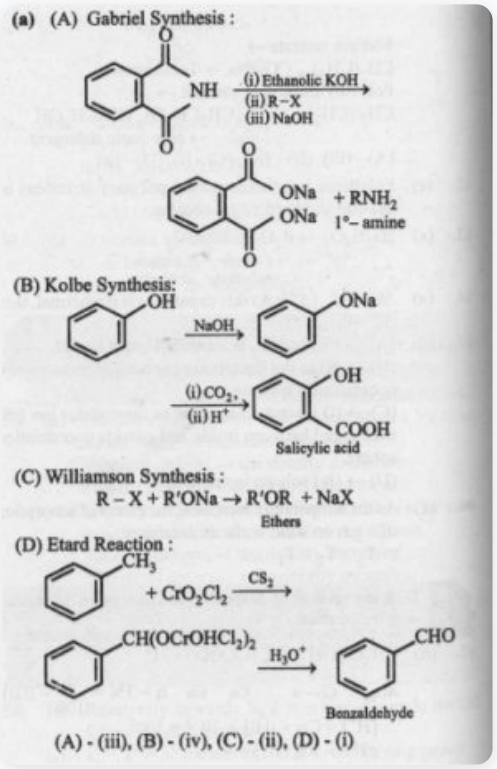
(A) (A)-(iii), (B)-(iv), (C)-(ii), (D)-(i)

(B) (A)-(ii), (B)-(iii), (C)-(i), (D)-(iv)

(C) (A)-(iii), (B)-(i), (C)-(ii), (D)-(iv)

(D) (A)-(iv), (B)-(iii), (C)-(i), (D)-(ii)

Explanation:



Question 76.

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

[4 Marks]

(A) Both X and Y are alkaline earth metals.

(B) X is an alkali metal and Y is an alkaline earth metal.

(C) X is an alkaline earth metal and Y is an alkali metal.

(D) Both X and Y are alkali metals.

Explanation:

X is an alkali metal and Y is alkaline earth metal.

Question 77.

The incorrect statement about denaturation of proteins is:

[4 Marks]

(A) A protein is formed from amino acids linked by peptide bonds.

(B) It results in loss of biological activity of proteins.

(C) Uncoiling of the helical structure takes place.

(D) It results due to change of temperature and/or pH.

Explanation:

Protein formation is not related to the denaturation of protein. The primary bonds remain intact during and after denaturation.

Question 78.

Four gas cylinders containing He, N_2, CO_2 and NH_3 gases separately are gradually cooled from a temperature of 500 K. Which gas will liquify first? (Given T_c in K - He: 5.3, N_2: 126, CO_2: 304.1 and NH_3: 405.5)

[4 Marks]

(A) NH_3

(B) He

(C) N_2

(D) CO_2

Explanation:

Higher Tc ⇒ Easier liquefaction.

Question 79.

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

Assertion (A): The metal carbon bond in metal carbonyls possesses both σ and π character.

Reason (R): The ligand to metal bond is a π bond and metal to ligand bond is a σ bond. In the light of the above statements, choose the most appropriate answer from the options given below:

[4 Marks]

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

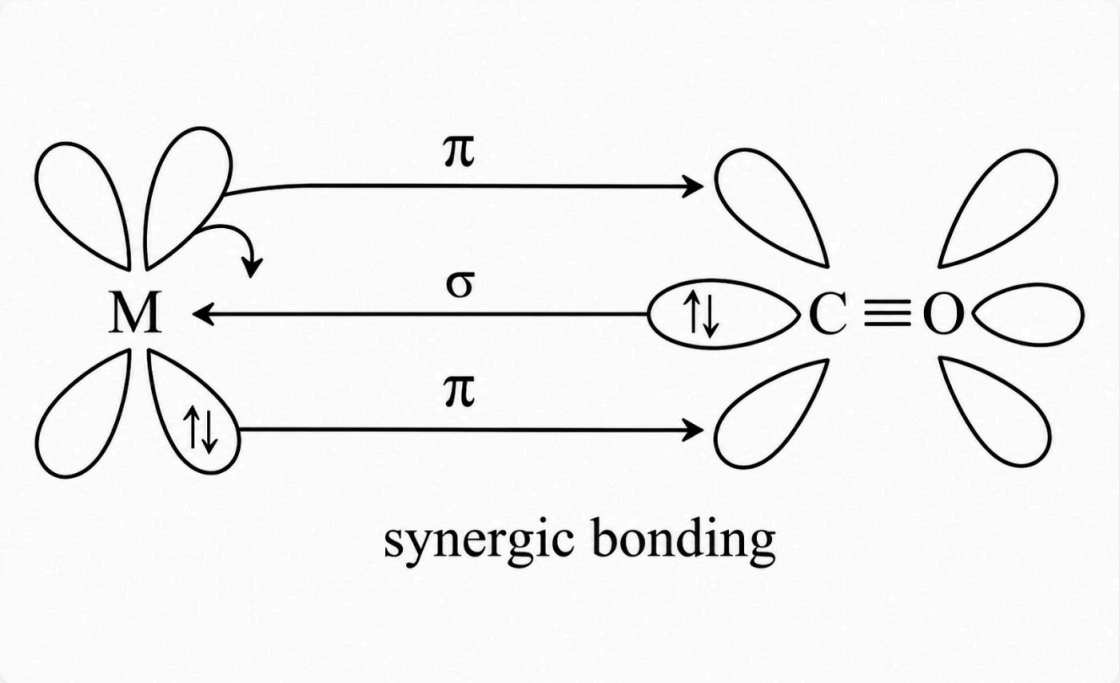
(B) Both (A) and (R) are correct and (R) is the correct explanation of (A)

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

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

Explanation:

M — CO bond has both σ and π -character. Assertion is correct. L → M bond forms the o-bond and M→ L forms the n-bond. Reason is not correct.



Question 80.

Match List - I with List - II:

Choose the correct answer from the options given below:

[4 Marks]

List – I		List – II	
(A)	Biochemical oxygen demand	(i)	oxidising mixture
(B)	Photochemical smog	(ii)	polar stratospheric cloud
(C)	Classical smog	(iii)	organic matter In water
(D)	Ozone layer depletion	(iv)	reducing mixture

(A) (A)-(iii), (B)-(iv), (C)-(i), (D)-(ii)

(B) (A)-(iii), (B)-(i), (C)-(iv), (D)-(ii)

(C) (A)-(i), (B)-(iv), (C)-(ii), (D)-(iii)

(D) (A)-(iv), (B)-(iii), (C)-(ii), (D)-(i)

Explanation:

Biochemical Oxygen Demand (BOD) → organic matter in water. Photochemical smog → Oxidizing smog has a high concentration of oxidizing agents.

Classical smog → Reducing has smoke, fog and SO_2 .

Ozone layer depletion - polar stratospheric clouds.

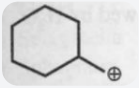
∴ (A)-(iii), (B)-(i), (C)-(iv), (D)-(ii).

Question 81.

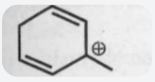
Which of the following is the most stable carbocation?

[4 Marks]

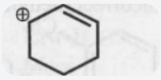
(A)



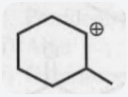
(B)



(C)



(D)

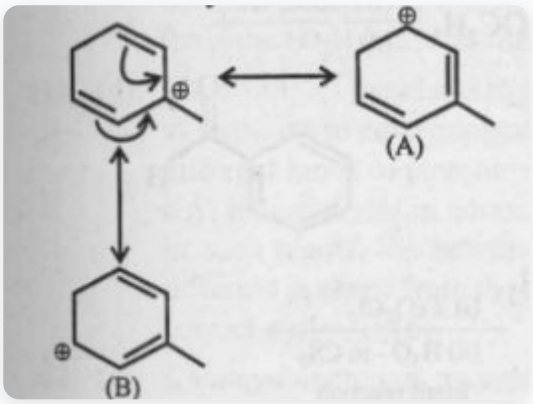


Explanation:

Stability of carbocation: 1° < 2° < 3°

Stability of carbocation α no. of resonating structure.

Two resonating structures and the initial carbocation is tertiary carbocation.



Question 82.

Given below are two statements:

Statement I: Cr^{2+} is oxidising and Mn^{3+} is reducing in nature.

Statement II: Sc^{3+} compounds are repelled by the applied magnetic field.

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

[4 Marks]

(A) Statement I is correct but Statement II is incorrect

(B) Both Statement I and Statement II are incorrect

(C) Statement I is incorrect but Statement II is correct

(D) Both Statement I and Statement II are correct

Explanation:

Cr^{2+} (22) → [Ar] $3d^4$ $4s^0$ → Tend to lose one electron so that it gains $t^3{}_2$_g electronic configuration in an octahedral field.

∴ Tend to form Cr^{2+} (d^4) → Cr^{3+} (d^3)

Mn^{3+} (d^4) tends to accept one electron to gain d^5 electronic configuration (Mn^{2+}).

Therefore, Mn^{3+} itself is reducing in character. Statement (I) is not completely correct.

Sc^{3+} (d^0) system; all electrons are paired; so diamagnetic and repelled by the magnetic field.

Question 83.

Kp for the following reaction is 3.0 at 1000 K. $CO_2(g) + C(s) \rightleftharpoons 2CO(g)$. What will be the value of Kc for the reaction at the same temperature? (Given R = 0.083 L bar K^{-1} mol^{-1})

[4 Marks]

(A) 3.6×10^{-2}

(B) 3.6×10^{-3}

(C) 0.36

(D) 3.6

Explanation:

Kp = Kc(RT)^Δng ; $\Delta n_g = 1 - 2 = -1$
Kc = Kp / RT
= 3 / (0.082 × 1000)
= 3 / 82
= 3.6×10^{-2}

Question 84.

A vessel contains 3.2 g of dioxygen gas at STP (273.15 K and 1 atm pressure). The gas is now transferred to another vessel at constant temperature, where pressure becomes one third of the original pressure. The volume of new vessel in L is: (Given - molar volume at STP is 22.4 L)

[4 Marks]

(A) 2.24

(B) 67.2

(C) 22.4

(D) 6.72

Explanation:

At isothermal condition,

$P_1V_1 = P_2V_2$

$n_O_2 = 3.2 / 32 = 0.1$ mole

At STP, 0.1 mole of oxygen contains 2.24 L (V_1).

$P_1 = 1$ atm, $P_2 = 1/3$ atm

$\therefore P_1V_1 = P_2V_2$

$1 \times 2.24 = (1/3) \times V_2$

$V_2 = 3 \times 2.24 = 6.72$ L

Question 85.

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

[4 Marks]

(A) 10×10^{-2} mol L^{-1} s^{-1} and 10×10^{-2} mol L^{-1}

(B) 1×10^{-2} mol L^{-1} s^{-1} and 10×10^{-2} mol L^{-1}

(C) 1×10^{-2} mol L^{-1} s^{-1} and 30×10^{-2} mol L^{-1}

(D) 10×10^{-2} mol L^{-1} s^{-1} and 30×10^{-2} mol L^{-1}

Explanation:

$4A + 3B \rightarrow 6C + 9D$

Rate of reaction:

$-1/4\ d[A]/dt = -1/3\ d[B]/dt = 1/6\ d[C]/dt = 1/9\ d[D]/dt$

$\therefore$ Rate of reaction $= 1/6\ d[C]/dt$

$= (1/6) \times 6 \times 10^{-2}$

$= 1 \times 10^{-2}$ mol L^{-1} s^{-1}

Now, $-1/3\ d[B]/dt = 1 \times 10^{-2}$

or, $-d[B]/dt = 3 \times 10^{-2}$

$\therefore$ Rate of consumption of B

$= 3 \times 10^{-2}$ mol L^{-1} s^{-1}

$\therefore$ Consumption of B in 10 s

$= 3 \times 10^{-2} \times 10$

$= 3 \times 10^{-1}$

$= 0.3$ mol L^{-1}

$= 30 \times 10^{-2}$ mol L^{-1}

Question 86.

Standard electrode potential for the cell with cell reaction $Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$ is 1.1 V. Calculate the standard Gibbs energy change for the cell reaction. (Given F = 96487 C mol^{-1})

[4 Marks]

(A) - 200.27 J mol^{-1}

(B) -200.27 kJ mol^{-1}

(C) -212.27 kJ mol^{-1}

(D) -212.27 J mol^{-1}

Explanation:

$\Delta G^\circ = -nFE^\circ cell$

$= -2 \times 96500 \times 1.1$ J mol^{-1}

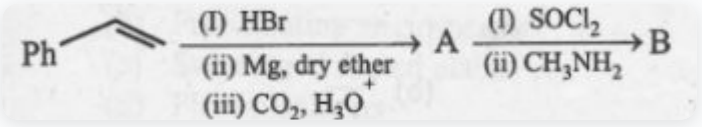
$= -212300$ J mol^{-1}

$= -212.3$ kJ mol^{-1}

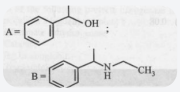
Question 87.

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

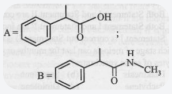
[4 Marks]



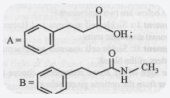
(A)



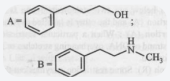
(B)



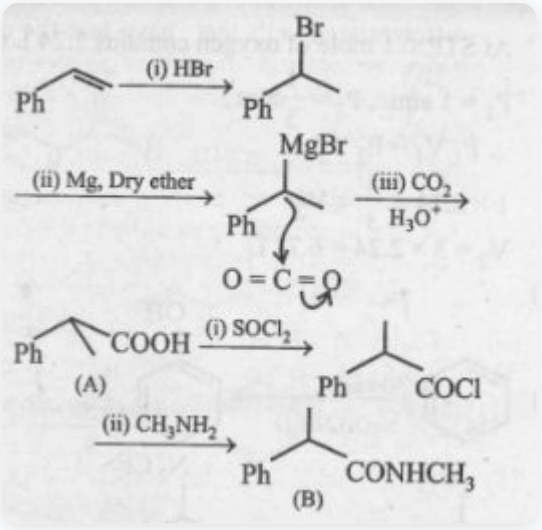
(C)



(D)



Explanation:



Question 88.

Which one of the following is not a calcination reaction?

[4 Marks]

(A) $CaCO_3 + 2HCl \xrightarrow{-\Delta} CaCl_2 + H_2O + CO_2$

(B) $ZnCO_3 \xrightarrow{-\Delta} ZnO + CO_2$

(C) $Fe_2O_3 \cdot xH_2O \xrightarrow{-\Delta} Fe_2O_3 + xH_2O$

(D) $CaCO_3 \cdot MgCO_3 \xrightarrow{-\Delta} CaO + MgO + 2CO_2$

Explanation:

$ZnCO_3(s) \xrightarrow{-\Delta} ZnO(s) + CO_2(g)$
$FeCO_3 \cdot xH_2O \xrightarrow{-\Delta} Fe_2O_3(s) + xH_2O(g)$
$CaCO_3 \cdot MgCO_3 \xrightarrow{-\Delta} CaO(s) + MgO + 2CO_2(g)$

Question 89.

The incorrect method for the synthesis of alkenes is:

[4 Marks]

(A) heating alkyl halides with alcoholic KOH

(B) treatment of alkynes with Na in liquid NH_3

(C) treating alkyl halides in aqueous KOH solution

(D) treating vicinal dihalides with Zn metal

Explanation:

Alcoholic KOH produces elimination product, alkene.
Aqueous KOH produces substitution product, alcohol.

Question 90.

When electromagnetic radiation of wavelength 300 nm falls on the surface of a metal, electrons are emitted with the kinetic energy of 1.68×10^5 J mol^{-1}. What is the minimum energy needed to remove an electron from the metal?

(h = 6.626×10^{-34} Js, c = 3×10^8 ms^{-1}, NA = 6.022×10^{23} mol^{-1})

[4 Marks]

(A) 2.31×10^5 J mol^{-1}

(B) 2.31×10^6 J mol^{-1}

(C) 3.84×10^4 J mol^{-1}

(D) 3.84×10^{-19} J mol^{-1}

Explanation:

$\lambda = 300$ nm
$E = hc/\lambda$
$= (6.627 \times 10^{-34} \times 3 \times 10^8) / (300 \times 10^{-9})$ J
$= 6.627 \times 10^{-19}$ J
For 1 mol, $\Rightarrow E = 6.627 \times 10^{-19} \times 6.023 \times 10^{23}$
$= 39.91 \times 10^4$ J mol^{-1}

$= 3.99 \times 10^5$ J mol^{-1}
$\therefore h\nu = \phi + K.E.$
$\therefore \phi = h\nu - K.E.$
$= 3.99 \times 10^5 - 1.68 \times 10^5$
$= 2.31 \times 10^5$ J mol^{-1}

Question 91.

What fraction of Fe exists as Fe(III) in $Fe_{0.96}O$?

(Consider $Fe_{0.96}O$ to be made up of Fe(II) and Fe(III) only)

[4 Marks]

(A) 1/20

(B) 1/12

(C) 1/16

(D) 0.08

Explanation:

Suppose, Fe^{2+} in $Fe_{0.96}O$ = x
and Fe^{3+} in $Fe_{0.96}O$ = 0.96 − x
∴ Total positive charge in $Fe_{0.96}O$
= (0.96 − x) × 3 + 2x

Total negative charge = 2 × 1 = 2
∴ (0.96 − x) × 3 + 2x = 2
or, 2.88 − 3x + 2x = 2
or, 2.88 − x = 2
x = 0.88
∴ Fe^{3+} = 0.96 − 0.88 = 0.08
∴ Fraction of Fe^{3+} = 0.08 / 0.96
= 8 / 96
= 1 / 12

Question 92.

Given below are two statements :

Statement I : Sickle cell anaemia and Haemophilia are autosomal dominant traits.

Statement II: Sickle cell anaemia and Haemophilia are disorders of the blood. In the light of the above statements, choose the correct answer from the options given below:

[4 Marks]

(A) Statement I is correct but Statement II is incorrect

(B) Both Statement I and Statement II are incorrect

(C) Both Statement I and Statement II are correct

(D) Statement I is incorrect but Statement II is correct

Explanation:

In the given statements, Statement I is incorrect and the statement II is correct. The correct statement is Sickle cell anaemia is autosomal recessive disorder and the haemophilia is sex linked recessive disorder.

Question 93.

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

[4 Marks]

(A) Diakinesis

(B) Diplotene

(C) Pachytene

(D) Leptotene

Explanation:

Diplotene stage of meiosis lasts for months or years in oocytes of some vertebrates.

Question 94.

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

Assertion (A) : When a particular restriction enzyme cuts strand of DNA, overhanging stretches or sticky ends are formed.

Reason (R): Some restriction enzymes cut the strand of DNA a little away from the centre of the palindromic site.

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

[4 Marks]

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

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

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

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

Explanation:

In the given statements both assertion and reason are correct and reason is the correct explanation of the assertion because restriction enzymes cut the strand of DNA a little away from the centre of the palindrome

sites, but between the same two bases on the opposite strands, then single stranded portions are left at the ends. These overhanging stretches on each strand are. called sticky ends. These are named so

because they form hydrogen bonds with their complementary cut counterparts. This stickiness of the ends facilitates the action of the enzyme DNA ligase.

Question 95.

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

(A) Plants (B) Invertebrates (C) Fishes (D) Mammals (E) Birds

Choose the correct answer from the options given below

[4 Marks]

(A) (A)>(B)>(E)>(D)>(C)

(B) (A)>(C)>(D)>(B)>(E)

(C) (B)>(A)>(E)>(D)>(C)

(D) (B)>(A)>(C)>(E)>(D)

Explanation:

'The Amazon rain forest that is present in South America

has the greatest biodiversity on earth in which more than 40,000 species of plants, more than 1,25,000 invertebrates, 3,000 of fishes, 427 of mammals, and 1,300 of birds are found.

Question 96.

In lac operon, z gene codes for :

[4 Marks]

(A) B-galactosidase

(B) Transacetylase

(C) Repressor

(D) Permease

Explanation:

In the lac operon, the z gene codes for beta-galactosidase (b-gal), which is primarily responsible for the hydrolysis of the disaccharide, lactose into

its monomeric units, galactose and glucose.

Question 97.

The 5-C compound formed during TCA cycle is:

[4 Marks]

(A) Oxalo succinic acid

(B) a-ketoglutaric acid

(C) Fumaric acid

(D) Succinic acid

Explanation:

In TCA cycle, the alpha Ketogluataric acid is a 5-C compound, Oxalosuccinic acid is a 6-C compound, whereas succinic acid and fumaric acid are and 4-C compounds.

Question 98.

In meiosis, crossing over and exchange of material between homologous chromosomes catalyzed by the enzyme:

[4 Marks]

(A) Phosphorylase

(B) Transferase

(C) Polymerase

(D) Recombinase

Explanation:

In meiosis, crossing over and exchange of genetic material between homologous chromosomes are catalyzed with the help of recombinase enzyme.

Question 99.

All successions irrespective of the habitat proceed to which type of climax community?

[4 Marks]

(A) Hydrophytic

(B) Xeric

(C) Mesic

(D) Edaphic

Explanation:

Xeric succession takes place in dry areas and the series progresses from xeric to mesic succession. Hence, both hydrach and xerach successions lead to medium water conditions (mesic). Mesic succession includes neither too dry (xeric) nor too wet (hydric).

Question 100.

When a carrier protein facilitates the movement of two molecules across the membrane in same direction, it is called :

[4 Marks]

(A) Antiport

(B) Transport

(C) Symport

(D) Uniport

Explanation:

In a symport, both molecules cross the membrane in the same direction. In an antiport, they move in opposite directions. When a molecule moves across a membrane independent of other molecules, the process is called uniport.

Question 101.

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

[4 Marks]

(A) 2 ATP + 1 NADPH

(B) 1 ATP + 2 NADPH

(C) 1 ATP + 1 NADPH

(D) 2 ATP + 2 NADPH

Explanation:

When one molecule of = CO_2 is fixed as one molecule of triose phosphate, 2 ATP and 2 NADPH are used in the reduction phase.

Question 102.

The ability of plants to follow different pathways in response to environment leading to formation of different kinds of structures is called :

[4 Marks]

(A) Redifferentiation

(B) Differentiation

(C) Development

(D) Plasticity

Explanation:

The ability of the Plants to follow different pathways in response to environment or phases of life to form different kinds of structures is known as plasticity, e.g., heterophylly in cotton, coriander and larkspur. In such plants, the leaves of the juvenile plant are different in shape from those in mature plants.

Question 103.

Match List-I with List-II :

Choose the correct answer from the options given below.

[5 Marks]

List – I	List - II
(A) Chlamydomonas	(i) Conidia
(B) Penicillium	(ii) Zoospores
(C) Hydra	(iii) Gemmules
(D) Sponge	(iv) Buds

(A) (A)-(iii), (B)-(i), (C)-(ii), (D)-(iv)

(B) (A)-(iii), (B)-(iv), (C)-(ii), (D)-(i)

(C) (A)-(ii), (B)-(iii), (C)-(i), (D)-(iv)

(D) (A)-(iii), (B)-(ii), (C)-(i), (D)-(iv)

Explanation:

Chlamydomonas is an example of unicellular alga. *Cycas* is an example of gymnosperm. *Selaginella* is an example of pteridophyte and *Sphagnum* is an example of moss.

Question 104.

The phenomenon by which the undividing parenchyma cells start to divide mitotically during plant tissue culture is called as :

[4 Marks]

(A) Secondary growth

(B) Differentiation

(C) Dedifferentiation

(D) Redifferentiation

Explanation:

The Phenomenon by which the undividing parenchyma cells start to divide mitotically during plant tissue culture is called as dedifferentiation. The living differentiated cells, that have lost the capacity to divide can regain the capacity of division under certain conditions. For example, formation of meristems – interfascicular cambium and cork cambium from fully differentiated parenchyma cells. While doing so, such meristems/tissues are able to divide and produce cells that once again lose the capacity to divide but mature to perform specific functions, i.e., get redifferentiated.

Question 105.

Interfascicular cambium is present between

[5 Marks]

(A) Primary xylem and primary phloem

(B) Secondary xylem and secondary phloem

(C) Pericycle and endodermis Two vascular bundles

(D) Two vascular bundles

Explanation:

Interfascicular cambium is found between primary xylem and primary phloem hence between two vascular bundles.

Question 106.

Which of the following growth regulators is an adenine derivative?

[4 Marks]

(A) Auxin

(B) Abscisic acid

(C) Ethylene

(D) Cytokinin

Explanation:

Cytokinin growth regulators is an adenine derivative.

Question 107.

The chromosomal theory of inheritance was proposed by

[4 Marks]

(A) Gregor Mendel

(B) Sutton Boveri

(C) Robert Brown

(D) Thomas Morgan

Explanation:

The chromosomal theory of inheritance was proposed by Sutton and Boveri. Sutton and Boveri argued that the pairing and separation of a pair of chromosomes would lead to the segregation of a pair of factors they carried.

Question 108.

Which of the following statements is not correct?

[4 Marks]

(A) The apical bud in rhizome always remains above the ground

(B) Rhizome is a condensed form of stem

(C) The rhizome is thick, prostrate and branched

(D) The rhizome is aerial with no distinct nodes and internodes

Explanation:

In the given statement, the statement 4 is incorrect, the correct statement is rhizome is a type of underground (sub-aerial) stem and bears distinct nodes and internodes.

Question 109.

Match List I- with List-II :

Choose the correct answer from the options given below.

[4 Marks]

List-I	List-II
(A) Adenine	(i) Pigment
(B) Anthocyanin	(ii) Polysaccharide
(C) Chitin	(iii) Alkaloid
(D) Codeine	(iv) Purine

(A) (A)-(i), (B)-(iv), (C)-(iii), (D)-(ii)

(B) (A)-(iv), (B)-(iii), (C)-(ii), (D)-(i)

(C) (A)-(iii), (B)-(i), (C)-(iv), (D)-(ii)

(D) (A)-(iv), (B)-(i), (C)-(ii), (D)-(iii)

Explanation:

Adenine is a type of purine, anthocyanin is an example of pigment, chitin is a homopolysaccharide and codeine is an example of alkaloid.

Question 110.

The residual persistent part which forms the perisperm in the seeds of beet is :

[4 Marks]

(A) Calyx

(B) Endosperm

(C) Integument

(D) Nucellus

Explanation:

In some seeds such as black pepper and beet, remnants of nucellus are persistent so the residual persistent part which forms the perisperm in the seeds of beet is nucellus.

Question 111.

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

[4 Marks]

(A) A significant reduction in the current rate of biodiversity loss.

(B) Collection and preservation of seeds of different genetic strains of commercially important plants.

(C) Increase in agricultural production.

(D) Declaration of more biodiversity hotspots.

Explanation:

The World Summit on Sustainable Development that held in 2002 in Johannesburg, South Africa and 190 countries pledged their commitment to achieve by 2010, a significant reduction in the current rate of biodiversity loss at global, regional and local levels.

Question 112.

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

[4 Marks]

(A) Collenchyma

(B) Parenchyma

(C) Sclereid

(D) Sclerenchyma

Explanation:

The sclereids are spherical, oval or cylindrical, highly thickened dead cells with narrow cavities (lumen). Sclereids are generally present in the fruit walls of nuts, pulp of fruits like guava, pear and sapota, seed coats of legumes and leaves of tea.

Question 113.

The pioneer species in a hydrarch succession are :

[4 Marks]

(A) Submerged rooted plants

(B) Phytoplanktons

(C) Free-floating angiosperms

(D) Filamentous algae

Explanation:

In primary succession in water, the pioneers are the small phytoplanktons, which are replaced with time by rooted-submerged plants, rooted-floating angiosperms followed by free-floating plants, then reed swamp, marsh-meadow, scrub and finally the trees.

Question 114.

Which of the following protects nitrogenase inside the root nodule of a leguminous plant?

[4 Marks]

(A) leg haemoglobin

(B) Catalase

(C) Transaminase

(D) Glutamate dehydrogenase

Explanation:

Leg-haemoglobin is called as oxygen scavenger. It is present in nodule and protects the enzyme nitrogenase. The enzyme nitrogenase is highly sensitive to the molecular oxygen and it requires anaerobic conditions. The nodules have adaptations that ensure that the enzyme is protected from oxygen.

Question 115.

Given below are two statements .

Statement I : DNA polymerases catalyses polymerisation only in one direction, that is 5' → 3'

Statement II : During replication of DNA, on one strand the replication is continuous while on the other strand it is discontinuous. In the light of the above statements, choose the correct answer from the options given below

[4 Marks]

(A) Both Statement I and Statement II are incorrect

(B) Statement I is incorrect but Statement II is correct

(C) Statement I is correct but Statement II is incorrect

(D) Both Statement I and Statement II are correct

Explanation:

In the given statement, both statements are correct. The main enzyme for DNA replication is DNA dependent DNA polymerase. DNA polymerases catalyse polymerisation only in one direction, that is 5 → 3 '. During replication of DNA, on one strand the replication is continuous while on other strand it is discontinuous.

Question 116.

The species that come to appear in bare area are called

[4 Marks]

(A) Competitive species

(B) Species of seral community

(C) Invasive species

(D) Pioneer species

Explanation:

The species that invade a bare area are called pioneer species. In primary succession on rocks these are usually lichens which are able to secrete acids to dissolve rock, helping in weathering and soil formation.

Question 117.

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

[4 Marks]

(A) Endodermis

(B) Cortex

(C) Epiblema

(D) Pericycle

Explanation:

A few layers of thick-walled parenchymatous cells known as pericycle in which initiation of lateral roots and vascular cambium takes place during the secondary growth.

Question 118.

Match List - I with List - II

Choose the correct answer from the options given below.

[4 Marks]

List - I	List - II
(A) In lac operon i gene codes for	(i) transacetylase
(B) In lac operon x z gen codes for	(ii) permease
(C) In lac operon y gene codes for	(iii) b-galactosidase
(D) In lac operon a gene for	(iv) Repressor codes

(A) (A)-(iii), (B)-(ii), (C)-(i), (D)-(iv)

(B) (A)-(iv), (B)-(iii), (C)-(ii), (D)-(i)

(C) (A)-(iii), (B)-(i), (C)-(iv), (D)-(ii)

(D) (A)-(i), (B)-(i), (C)-(iii), (D)-(ii)

Explanation:

a. The *i* gene codes for the repressor of the *lac* operon.

b. The *z* gene codes for beta-galactosidase (b-gal).

c. The *y* gene codes for permease.

d. The *a* gene encodes a transacetylase.

Question 119.

To ensure that only the desired pollens fall on the stigma in artifical hybridization process

(A) the female flower buds of plant producing unisexual flowers need not be bagged

(B) there is no need to emasculate unisexual flowers of selected female parent

(C) emasculated flowers are to be bagged immediately after cross pollination

(D) emasculated flowers are to be bagged after removal of anthers bisexual flowers, showing protogyny are never selected for cross

Choose the correct answer from the options given below:

[4 Marks]

(A) (B), (C) and (D) only

(B) (A), (D) and (E) only

(C) (A), (B) and (C) only

(D) (B), (C) and (E) only

Explanation:

In the given statement only statements b, c and d are correct. In artificial cross hybridisation when female parent is bisexual then emasculation is done that is removal of anthers, before it dehisce. If female parent is unisexual, there is no need of emasculation. After emasculation, flowers are bagged to prevent contamination of stigma. Desired pollen grains are dusted on stigma and it is rebagged after cross pollination. Bisexual flowers which show protogynous condition can also be used for artificial hybridisation.

Question 120.

The ascent of xylem sap in plants is mainly accomplished by the:

[4 Marks]

(A) size of the stomatal aperture

(B) distribution of stomata on the upper and lower epidermis

(C) cohesion and adhesion between water molecules

(D) root pressure

Explanation:

Ascent of xylem sap depends mainly on the following physical properties of water:

- Cohesion – mutual attraction between water molecules.
- Adhesion – attraction of water molecules to polar surfaces (such as the surface of tracheary elements).

Question 121.

Match List - I with List - IT :

Choose the correct answer from the options given below

[4 Marks]

List - I	List - II
(A) Imbricate	(i) Calotropis
(B) Valvate	(ii) Cassia
(C) Vexillary	(iii) Cotton
(D) Twisted	(iv) Bean

(A) (A)-(ii), (B)-(iv), (C)-(iii), (D)-(i)

(B) (A)-(ii), (B)-(i), (C)-(iii), (D)-(iv)

(C) (A)-(ii), (B)-(i), (C)-(iv), (D)-(iii)

(D) (A)-(i), (B)-(iii), (C)-(iv), (D)-(ii)

Explanation:

a. The aestivation in *Cassia* flowers is called as imbricate.

b. *Calotropis* has valvate type of aestivation.

c. Bean flowers, have vexillary or papilionaceous type of aestivation.

d. The aestivation of cotton is twisted.

Question 122.

The number of time(s) decarboxylation of isocitrate occurs during single TCA cycle is:

[5 Marks]

(A) Four

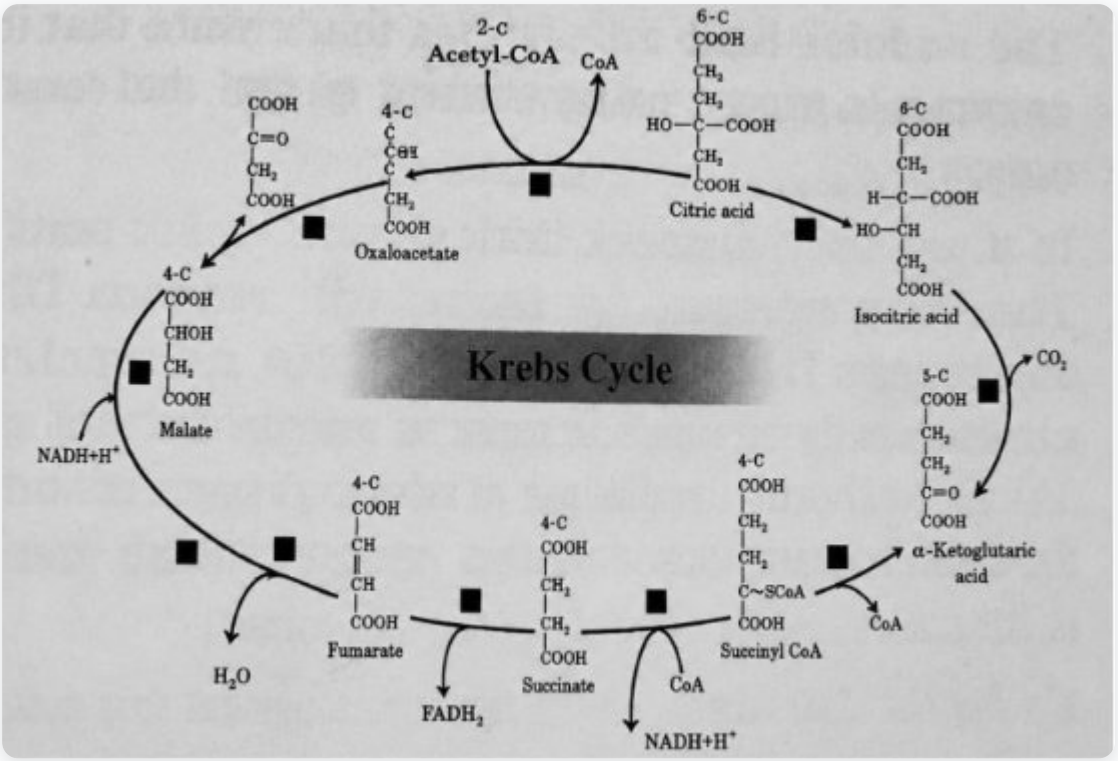
(B) Three

(C) One

(D) Two

Explanation:

The TCA cycle starts with the condensation of acetyl group with oxaloacetic acid (OAA) and water to yield citric acid. The reaction is catalysed by the enzyme citrate synthase and a molecule of CoA is released. Citrate is then isomerised to isocitrate. At 4th step of TCA cycle, isocitrate gives off a pair of H atoms and a molecule of CO2(decarboxylation) and becomes 5-C alpha-Ketoglutarate.



Question 123.

Match List - I with List - II:

Choose the correct answer from the options given below:

[4 Marks]

List –I	List –II
(A) Porins	(i) Pink coloured nodules
(B) leg haemoglobin	(ii) Lumen of thylakoid
(C) H+accumulation	(iii) Amphibolic pathway
(D) Respiration	(iv) Huge pores in outer membrane of mitochondria

(A) (A)-(ii), (B)-(iv), (C)-(i), (D)-(iii)

(B) (A)-(ii), (B)-(i), (C)-(iv), (D)-(iii)

(C) (A)-(iii), (B)-(iv), (C)-(ii), (D)-(i)

(D) (A)-(iv), (B)-(i), (C)-(ii), (D)-(iii)

Explanation:

a. The porins are proteins that form large pores in the outer membranes of the plastids, mitochondria and some bacteria. b. The pink colour of nodules of the plant is due to the presence of leg-haemoglobin that is oxygen scavenger.

c. H + accumulation takes place in the lumen of the thylakoid.

d. Respiration is a type of amphibolic pathway because in this reaction both anabolic and catabolic processes takes place.

Question 124.

Separation of DNA fragments is done by a technique known as

[4 Marks]

(A) Gel electrophoresis

(B) Southern blotting

(C) Polymerase Chain Reaction

(D) Recombinant technology

Explanation:

Gel electrophoresis is a type of technique that is used to separate the fragments of DNA. The formation of the fragments of DNA takes place by the enzyme, restriction endonuclease.

Question 125.

In general the egg apparatus of embryo sac in angiosperm consists of

[4 Marks]

(A) One egg cell, two synergids, two antipodal cells, two Polar nuclei

(B) One egg cell, three synergids, two antipodal cells, two Polar nuclei

(C) One egg cell, two synergids, three antipodal cells, two Polar nuclei

(D) One egg cell, two synergids, two antipodal cells, three Polar nuclei

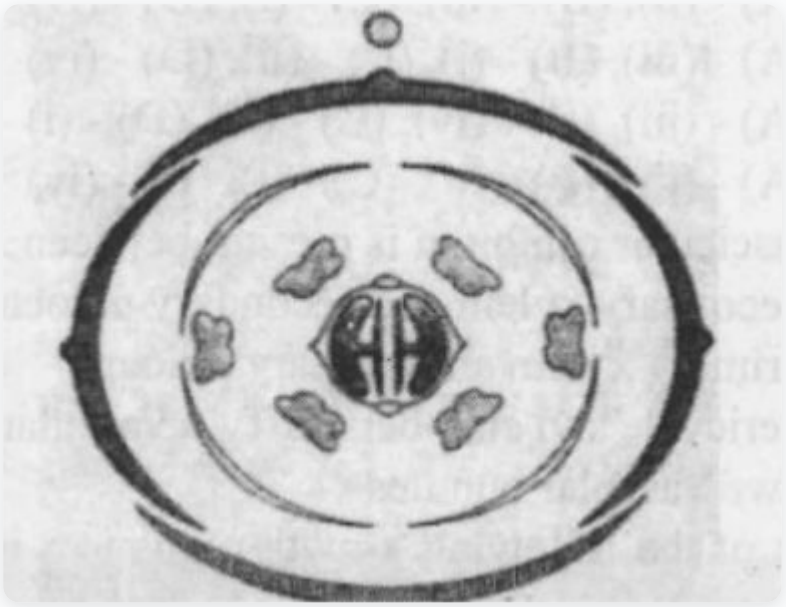
Explanation:

In general the egg apparatus of embryo sac in angiosperm consists of one egg cell, two synergids, three antipodal cells, two polar nuclei.

Question 126.

The Floral Diagram represents which one of the following families

[4 Marks]



(A) Fabaceae

(B) Brassicaceae

(C) Solanaceae

(D) Liliaceae

Explanation:

The given diagram shows the floral diagram of family Brassicaceae.

The floral formula of the family Brassicaceae is $K_{2+2}\ C_4\ A_{2+4}\ G_{(2)}$

Question 127.

Primary proteins are also called as polypeptides because :

[4 Marks]

(A) They can assume many conformations

(B) They are linear chains

(C) They are polymers of peptide monomers

(D) Successive amino acids are joined by peptide bonds

Explanation:

Primary proteins are also called as polypeptides because successive amino acids are joined by peptide bonds.

Question 128.

Match List-I with List-II :

Choose the correct answer from the options given below:

[3 Marks]

List-I	List-II
(A) Bacteriophage ϕX174	(i) 48502 base pairs
(B) Bacteriophage Lambda	(ii) 5386 nucleotides
(C) Escherichia coli Base pairs	(iii) 3.3 × 109
(D) Haploid content Of human DNA	(iv) 4.6 × 106 base pairs

(A) (A)-(ii), (B)-(i), (C)-(iv), (D)-(iii)

(B) (A)-(i), (B)-(ii), (C)-(iii), (D)-(iv)

(C) (A)-(ii), (B)-(iv), (C)-(i), (D)-(iii)

(D) (A)-(i), (B)-(ii), (C)-(iv), (D)-(iii)

Explanation:

Bacteriophage Φ × 174 contains 5386 nucleotides.

Bacteriophage lambda contains 48502 basepairs.

Escherichia coli contains 4.6 × 106 basepairs.

Haploid content of human DNA contains 3.3 × 109 basepairs.

Question 129.

Which type of substance would face difficulty to pass through the cell membrane?

[4 Marks]

(A) Substance with hydrophobic moiety

(B) All substance irrespective of hydrophobic and hydrophilic moiety

(C) Substance with hydrophilic moiety

(D) Substance soluble in lipids

Explanation:

Transport of any substance across the membrane depends on its solubility in lipids. The cell membrane is mainly composed of lipids and proteins. The major lipids are phospholipids that are arranged in a bilayer so substances with hydrophilic moiety would face difficulty to pass through the cell membrane.

Question 130.

What is the expected percentage of F2 progeny with yellow and inflated pod in dihybrid cross experiment involving pea plants with green coloured, inflated pod and yellow coloured constricted pod?

[4 Marks]

(A) 9%

(B) 100%

(C) 56.25%

(D) 18.75%

Explanation:

Since the green pod (G) colour is dominant over yellow pod colour (g) and inflated pod (I) is dominant over constricted pod (i). So, Green, Inflated Pod X Yellow, constricted Pod. After cross all F1 progeny will be dominant green, inflated plants and the phenotypic ratio of F2 plants will be 9:3:3:1.

- Green, inflated - 9
- Green, constricted - 3
- Yellow, inflated - 3
- Yellow, constricted - 1

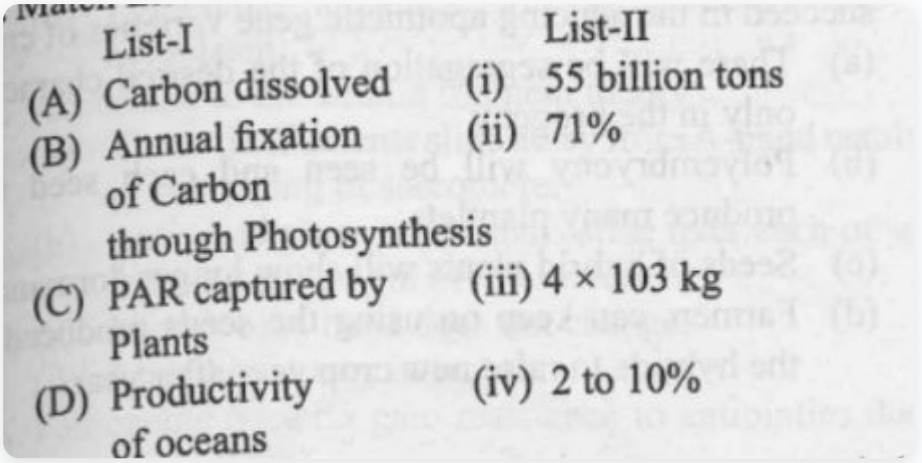
  Thus the % of yellow inflated plants will be 3/16 = 18.75%.

Question 131.

Match List I with List - II:

Choose the correct answer from the options given below:

[3 Marks]



List-I	List-II
(A) Carbon dissolved	(i) 55 billion tons
(B) Annual fixation of Carbon through Photosynthesis	(ii) 71%
(C) PAR captured by Plants	(iii) 4 × 103 kg
(D) Productivity of oceans	(iv) 2 to 10%

(A) (A)-(ii), (B)-(iii), (C)-(iv), (D)-(i)

(B) (A)-(iii), (B)-(iv), (C)-(ii), (D)-(i)

(C) (A)-(ii), (B)-(iv), (C)-(iii), (D)-(i)

(D) (A)-(iii), (B)-(ii), (C)-(i), (D)-(iv)

Explanation:

a. Carbon dissolved in oceans - 71%

b. Annual fixation of carbon through photosynthesis - 4 x 103 Kg

c. PAR captured by plants - 2 to 10%

d. Productivity of oceans - 55 billion tons.

Question 132.

If a female individual is with small round head, furrowed tongue, partially open mouth and broad palm with characteristic palm crease. Also the physical, psychomotor and mental development is retarded. The karyotype analysis of such an individual will show:

[4 Marks]

(A) 47 chromosomes with XXY sex chromosomes

(B) Trisomy of chromosome 21

(C) 45 chromosomes with XO sex chromosomes

(D) 47 Chromosomes with XYY sex chromosomes

Explanation:

If a female individual is with small round head, furrowed tongue, partially open mouth and broad palm with characteristic palm crease. Also the physical, psychomotor and mental development is retarded. These are the symptoms of Down's syndrome. In this genetic disorder an additional copy of the chromosome number 21 (trisomy of 21) is present. So the karyotype analysis of such an individual will show trisomy of chromosome 21.

Question 133.

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

(A) It is a member of Chlorophyceae

(B) Food is stored in the form of starch

(C) It is a monoecious plant showing oogonium and antheridium

(D) Food is stored in the form of laminarin or mannitol

(E) It shows dominance of pigments Chlorophyll a, c and Fucoxanthin

Choose the correct answer from the options given below:

[4 Marks]



(A) (A) and (B) only

(B) (C), (D) and (E) only

(C) (A), (B) and (C) only

(D) (A), (C) and (D) only

Explanation:

The alga shown in the diagram is *Chara* that is monoecious plant. It is a member of Chlorophyceae and the food is stored in the form of starch.

Question 134.

The enzyme (a) is needed for isolating genetic material from plant cells and enzyme (b) for isolating genetic material from fungus. Choose the correct pair of options from the following:

[4 Marks]

(A) (a) Cellulase (b) Lipase

(B) (a) Chitinase (b) Lipase

(C) (a) Cellulase (b) Protease

(D) (a) Cellulase (b) Chitinase

Explanation:

The enzyme cellulase is used for isolating genetic material from plant cells and enzyme chitinase is used for isolating genetic material from fungus.

Question 135.

Identify the correct sequence of events during Prophase I of meiosis: (A) Synapsis of homologous chromosomes (B) Chromosomes become gradually visible under microscope (C) Crossing over between non-sister chromatids of homologous chromosomes (D) Terminalisation of chiasmata (E) Dissolution of synaptonemal complex Choose the correct answer from the options given below:

[4 Marks]

(A) (B), (A), (C), (E), (D)

(B) (A), (B), (C), (D), (E)

(C) (B), (C), (D), (E), (A)

(D) (A), (C), (D), (E), (B)

Explanation:

The prophase I of meiosis is subdivided into five phases based on chromosomal behaviour, i.e., Leptotene, Zygotene, Pachytene, Diplotene and Diakinesis. The correct sequence of events during Prophase I of meiosis is:- Chromosomes become gradually visible under microscope during leptotene stage -> during zygotene stage synapsis of homologous chromosomes takes place -> crossing over

between non-sister chromatids of homologous chromosomes occurs in pachytene stage -> In diplotene stage, dissolution of synaptonemal complex occurs -> terminalisation of chiasmata takes place during diakinesis.

Question 136.

Which of the following pair represents free living nitrogen fixing aerobic bacteria?

[4 Marks]

(A) Azotobacter and Beijernickia

(B) Anabaena and Rhodospirillum

(C) Rhizobium and Beijernickia

(D) Pseudomonas and Thiobacillus

Explanation:

Azotobacter and *Beijerinckia* are the examples of free living nitrogen fixing aerobic bacteria.

Question 137.

Frugivorous birds are found in large numbers in tropical forests mainly because of:

[4 Marks]

(A) availability of fruits throughout the year

(B) lack of niche specialisation

(C) temperature conducive for their breeding

(D) higher annual rainfall

Explanation:

Frugivorous birds are those birds that eat fruits so they are found in large numbers in tropical forests mainly because of availability of fruits throughout the year.

Question 138.

Identify the correct statements regarding chemiosmotic hypothesis: (A) Splitting of the water molecule takes place on the inner side of the membrane. (B) Protons accumulate within the lumen of the thylakoids. (C) Primary acceptor of electron transfers the electrons to an electron carrier. (D) NADP reductase enzyme is located on the stroma side of the membrane. (E) Protons increase in number in stroma. Choose the correct answer from the options given below:

[4 Marks]

(A) (B), (C) and (E)

(B) (A), (B) and (D)

(C) (B), (C) and (D)

(D) (A), (B) and (E)

Explanation:

In the given statements about chemiosmotic hypothesis, statements (c) and (e) are incorrect. The correct statements are, primary acceptor of electron transfers its electron to a proton carrier not to an electron carrier and protons increase in number in lumen of the thylakoid not in stroma.

Question 139.

Match List-I with List-II:

Choose the correct answer from the options given below:

[4 Marks]

List-I		List-II	
(A)	Gene gun	(i)	Replacement of a faulty gene normal healthvelthy gene
(B)	Gene therapy	(ii)	Used for transfer of Gene
(C)	Gene cloning	(iii)	Total DNA in the cells of an organism
(D)	Genome	(iv)	To obtain identical copies of aparticular DNA molecule

(A) (A)-(iv), (B)-(i), (C)-(iii), (D)-(ii)

(B) (A)-(ii), (B)-(iii), (C)-(iv), (D)-(i)

(C) (A)-(i), (B)-(iii), (C)-(ii), (D)-(iv)

(D) (A)-(ii), (B)-(i), (C)-(iv), (D)-(iii)

Explanation:

(a) Gene gun - Used for transfer of gene in plant cells.

- (b) Gene therapy - Replacement of a faulty gene by a normal healthy gene
- (c) Gene cloning - To obtain identical copies of a particular DNA molecule

- (d) Genome - Total DNA in the cells of an organism

Question 140.

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

[4 Marks]

(A) Seeds of hybrid plants will show longer dormancy

(B) Polyembryony will be seen and each seed will produce many plantlets

(C) There will be segregation of the desired characters only in the progeny

(D) Farmers can keep on using the seeds produced by the hybrids to raise new crop year after year

Explanation:

If the hybrids are made into apomicts, there is no segregation of characters in the hybrid progeny. Then the farmers can keep on using the hybrid seeds to raise new crop year after year and they does not have to buy hybrid seeds every year.

Question 141.

Which of the following animals has three chambered heart?

[4 Marks]

(A) Chelone

(B) Scoliodon

(C) Hippocampus

(D) Pteropus

Explanation:

Chelone (turtle) is an example of a reptile. The heart of reptiles is usually three-chambered, with the exception of crocodiles.

Question 142.

Which of the following types of epithelium is present in the bronchioles and Fallopian tubes?

[4 Marks]

(A) Stratified squamous epithelium

(B) Simple squamous epithelium

(C) Simple columnar epithelium

(D) Ciliated epithelium

Explanation:

Ciliated epithelium is a type of columnar or cuboidal epithelium that bears cilia on its free surface. It is mainly present in the inner surface of hollow organs like bronchioles and fallopian tubes. Its function is to move particles or mucus in a specific direction over the epithelium.

Question 143.

Which of the following is not an Intra Uterine Device?

[4 Marks]

(A) Progestasert

(B) Progestogens

(C) Multiload 375

(D) Lippes loop

Explanation:

The Intra Uterine Devices (IUDs) are a *type of contraception*. These are small devices that are inserted by doctors or expert nurses in the uterus through vagina. These Intra Uterine Devices are presently available as the non-medicated IUDs (e.g., Lippes loop), copper releasing IUDs (CuT, Cu7, Multiload 375) and the hormone releasing IUDs (Progestasert, LNG-20). Thus Progestogens are not example of IUDs.

Question 144.

Match List - I with List - II:

Choose the correct answer from the options given below:

[4 Marks]

List-I	List-II
(A) Chlamydomonas	(i) Moss
(B) Cycas	(ii) Pteridophyte
(C) Selaginella	(iii) Alga
(D) Sphagnum	(iv) Gymnosperm

(A) (A)-(i), (B)-(iv), (C)-(iii), (D)-(ii)

(B) (A)-(iv), (B)-(iii), (C)-(ii), (D)-(i)

(C) (A)-(ii), (B)-(i), (C)-(iv), (D)-(iii)

(D) (A)-(iii), (B)-(ii), (C)-(i), (D)-(iv)

Explanation:

Chlamydomonas asexually reproduces by zoospores. *Penicillium* asexually reproduces by conidia formation. *Hydra* reproduces by budding. Sponges produce gemmules for asexual reproduction.

Question 145.

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

[4 Marks]

(A) Auto-immune response

(B) Inability of recipient to differentiate between 'self' and 'non-self' tissues/cells

(C) Humoral immune response only

(D) Cell-mediated response

Explanation:

Cell-mediated immune response is mainly responsible for graft rejection in transplantation of organs.

Question 146.

Bivalent or Tetrad formation is a characteristic feature observed during:

[4 Marks]

(A) Synaptonemal complex in Pachytene stage

(B) Chiasmata in Diplotene stage

(C) Chiasmata in zygotene stage

(D) Synaptonemal complex in zygotene stage

Explanation:

The complex formed by a pair of synapsed homologous chromosomes is called a bivalent or a tetrad. It is a characteristic feature that is observed during the zygotene stage when the homologous chromosomes undergo synapsis.

Question 147.

Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R). Assertion (A): FSH which interacts with membrane bound receptors does not enter the target cell. Reason (R): Binding of FSH to its receptors generates second messenger (cyclic AMP) for its biochemical and physiological responses. In the light of the above statements, choose the most appropriate answer from the options given below:

[4 Marks]

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

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

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

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

Explanation:

In the given statements, both assertion and reason are correct but reason is not the correct explanation of assertion.

Question 148.

Choose the correct statement about a muscular tissue:

[4 Marks]

(A) Intercalated discs allow the cardiac muscle cells to contract as a unit.

(B) The walls of blood vessels are made up of columnar epithelium.

(C) Smooth muscles are multinucleated and involuntary.

(D) Skeletal muscle fibres are uninucleated and found in parallel bundles.

Explanation:

In the given statements about muscular tissue, only statement (c) is correct. Communication junctions (intercalated discs) at some fusion points allow the cells to contract as a unit, i.e., when one cell receives a signal to contract, its neighbours are also stimulated to contract. Smooth muscle fibres are uninucleated not multinucleated

Skeletal muscle fibres are multinucleated not uninucleated.

The wall of blood vessels are made up of simple squamous epithelium not columnar epithelium.

Question 149.

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

[4 Marks]

(A) Pons

(B) Medulla

(C) Cerebrum

(D) Thalamus

Explanation:

Pons are the region of human brain which has pneumotaxic centre that alters respiratory rate by reducing the duration of inspiration.

Question 150.

The amount of biomass or organic matter produced per unit area over a time period by plants during photosynthesis is called:

[4 Marks]

(A) Secondary production

(B) Gross primary production

(C) Net primary production

(D) Primary production

Explanation:

Primary production is defined as the amount of biomass or organic matter produced per unit area over a time period by plants during photosynthesis. It is expressed in terms of weight (gm-2) or energy (kcal m-2). The rate of biomass production is called productivity. It is expressed in terms of gm-2 yr-1

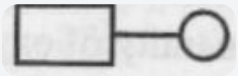
or (kcal m-2) yr-1 to compare the productivity of different ecosystems. It can be divided into gross primary productivity (GPP) and net primary productivity (NPP). Gross primary productivity of an ecosystem is the rate of production of organic matter during photosynthesis. A considerable amount of GPP is utilised by plants in respiration. Gross primary productivity minus respiration losses (R), is the net primary productivity (NPP).

Question 151.

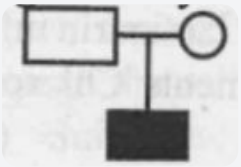
Select the incorrect match regarding the symbols used in Pedigree analysis

[4 Marks]

(A) Consanguineous mating



(B) Parent with male child affected with disease



(C) Sex unspecified

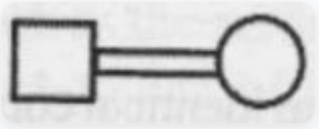


(D) Affected individual



Explanation:

Symbol is used in the human pedigree analysis to indicate the mating between relative (consanguineous mating). So symbol given in the option (4) is incorrect.



Question 152.

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

[4 Marks]

(A) Hydrolytic enzymes will become inactive

(B) Hydrolytic enzymes will function more efficiently

(C) Lysosomal enzymes will be released into the cytoplasm

(D) Lysosomal enzymes will be more active

Explanation:

Lysosomes are very rich in almost all types of hydrolytic enzymes (hydrolases - lipases, proteases, carbohydrases) and are optimally active at the acidic pH. If pH in lysosomes is increased to alkaline or basic then hydrolytic enzymes will become inactive.

Question 153.

According to the sliding filament theory:

[4 Marks]

(A) I-band increases in length.

(B) Length of A-band does not change.

(C) Actin and myosin filaments slide over each other to increase the length of the sarcomere.

(D) The actin filaments slide away from A-band resulting in shortening of sarcomere.

Explanation:

The sliding filament theory states that contraction of a muscle fibre takes place by the sliding of the thin filaments over the thick filaments. According to this theory, during shortening of the muscle, i.e., contraction, the 'I' bands get reduced, whereas the 'A' bands retain the length that means length of A-band does not change.

Question 154.

Pathogenic bacteria gain resistance to antibiotics due to changes in their:

[4 Marks]

(A) Nucleoid

(B) Cosmids

(C) Nucleus

(D) Plasmids

Explanation:

Plasmid is an autonomously replicating circular extra-chromosomal DNA. The plasmid DNA provides certain unique phenotypic characters to the bacteria such as resistance to antibiotics.

Question 155.

Panspermia, an idea that is still a favourite for some astronomers, means:

[4 Marks]

(A) Creation of life from chemicals

(B) Origin of sperm in human testes

(C) Transfer of spores as unit of life from other planets to Earth

(D) Creation of life from dead and decaying matter

Explanation:

Early Greek thinkers thought units of life called spores were transferred to different planets including earth. 'Panspermia' is still a favourite idea for some astronomers transfer of spores as unit of life from other planets to earth.

Question 156.

Why CNG is considered better fuel than diesel?

(A) It can not be adulterated.

(B) It takes less time to fill the fuel tank.

(C) It burns more efficiently.

(D) It is cheaper.

(E) It is less inflammable.

Choose the most appropriate answer from the options given below:

[4 Marks]

(A) (A), (B), (C), (E) only

(B) (C), (D), (E) only

(C) (A), (C), (D) only

(D) (A), (B), (D), (E) only

Explanation:

Due to following reasons CNG is better fuel than diesel because:-

- It cannot be adulterated
- It burns more efficiently than diesel or petrol
- It is cheaper

Question 157.

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

(A) It includes ERV, TV and IRV.

(B) Total volume of air a person can inspire after a normal expiration.

(C) The maximum volume of air a person can breathe in after forced expiration.

(D) It includes ERV, RV and IRV.

(E) The maximum volume of air a person can breathe out after a forced inspiration.

Choose the most appropriate answer from the options given below:

[4 Marks]

(A) (A), (C) and (D)

(B) (A) and (E)

(C) (A), (C) and (E)

(D) (B), (D) and (E)

Explanation:

Vital Capacity (VC) is defined as the maximum volume of air a person can breathe in after a forced expiration. This includes ERV, TV and IRV or the maximum volume of air a person can breathe out after a forced inspiration. In the given statements, statements (i), (iii) and (v) are correct about vital capacity.

Question 158.

How many secondary spermatocytes are required to form 400 million spermatozoa?

[4 Marks]

(A) 50 million

(B) 400 million

(C) 200 million

(D) 100 million

Explanation:

Since one primary spermatocyte produces two secondary spermatocytes during the meiosis I and one secondary spermatocyte produces two spermatozoa during meiosis II. Thus 200 million secondary spermatocytes will be required to produce 400 million spermatozoa.

Question 159.

Mad cow disease in cattle and Cr Jacob disease in humans are due to infection by.....

[4 Marks]

(A) Virus

(B) Bacterium

(C) Prion

(D) Viroid

Explanation:

Prions are infectious agent that are consisting of abnormally folded protein. The agent was similar in size to viruses. The most notable diseases caused by prions are bovine spongiform encephalopathy (BSE) commonly called mad cow disease in cattle and its analogous variant Cr-Jacob disease (CJD) in humans.

Question 160.

Arrange the components of mammary gland (from proximal to distal):

(A) Mammary duct

(B) Lactiferous duct

(C) Alveoli

(D) Mammary ampulla

(E) Mammary tubules

Choose the most appropriate answer from the options given below:

[4 Marks]

(A) (C) → (A) → (D) → (E) → (B)

(B) (E) → (C) → (D) → (B) → (A)

(C) (C) → (E) → (A) → (D) → (B)

(D) (B) → (C) → (E) → (D) → (A)

Explanation:

The glandular tissue of each breast is divided into 15-20 mammary lobes containing clusters of cells called alveoli. The alveoli open into mammary tubules. The tubules of each lobe join to form a mammary duct. Several mammary ducts join to form a wider mammary ampulla which is connected to lactiferous duct through which milk is sucked out. Thus, alveoli -> Mammary tubules -> Mammary duct -> Mammary ampulla -> Lactiferous duct.

Question 161.

Western Ghats have a large number of plants and animal species that are not found anywhere else. Which of the following term is used to notify such species?

[4 Marks]

(A) Threatened species

(B) Vulnerable species

(C) Endemic species

(D) Keystone species

Explanation:

Endemic species are those species that are confined to a particular region such as Western Ghats and not found anywhere else.

Question 162.

Match List I with List II

Choose the correct answer from the options given below:

[4 Marks]

List - I	List - II
(A) Crop	(i) grinding the food particles
(B) Proventriculus	(ii) secretion of digestive juice
(C) Hepatic caecae	(iii) removal of nitrogenous waste
(D) Malpighian tubules	(iv) storage of food

(A) (A)-(i), (B)-(iv), (C)-(iii), (D)-(ii)

(B) (A)-(ii), (B)-(iv), (C)-(i), (D)-(iii)

(C) (A)-(iii), (B)-(ii), (C)-(i), (D)-(iv)

(D) (A)-(iv), (B)-(i), (C)-(ii), (D)-(iii)

Explanation:

Crop – Storage of food.

- Proventriculus – Grinding the food particles.
- Hepatic caecae – Secretion of digestive juice.
- Malpighian tubules – Removal of nitrogenous waste.

Question 163.

Two butterfly species are competing for the same nectar of a flower in a garden. To survive and coexist together, they may avoid competition in the same garden by:

[4 Marks]

(A) predating on each other

(B) choosing different foraging patterns

(C) increasing time spent on attacking each other

(D) feeding at the same time

Explanation:

If two species compete for the same resource, they could avoid competition by choosing, for instance, different times for feeding or different foraging patterns. Thus when two butterfly species are

competing for the same nectar of a flower in a garden. To survive and coexist together, they may avoid competition in the same garden by choosing different foraging patterns.

Question 164.

Role of enamel is to:

[4 Marks]

(A) Form bolus

(B) Masticate the food

(C) Give basic shape to the teeth

(D) Connect crown of tooth with its root

Explanation:

The hard chewing surface of the teeth is made up of enamel that helps in the process of mastication of food.

Question 165.

Choose the incorrect enzymatic reaction.

[4 Marks]

(A) Lactose → (Lactase) Glucose + Galactose

(B) Sucrose → (Sucrase) Glucose + Fructose

(C) Dipeptides → (Dipeptidases) Amino acids

(D) Maltose → (Maltase) Glucose + Galactose

Explanation:

Maltose is an example of disaccharide which is dissocioated or hydrolysed into two molecules of glucose

Maltose → Glucose + Glucose

Question 166.

Given below are two statements one is labelled as Assertion

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

(A): During pregnancy the level of thyroxine is increased in the maternal blood.

Reason (R): Pregnancy is characterised by metabolic changes in the mother.

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

[4 Marks]

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

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

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

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

Explanation:

In the given statements both assertion and reason are correct and reason is the correct explanation of assertion.

Question 167.

Choose the correct statements:

(A) Bones support and protect softer tissues and organs

(B) Weight bearing function is served by limb bones

(C) Ligament is the site of production of blood

(D) Adipose tissue is specialised to store fats.

(E) Tendons attach one bone to another.

Choose the most appropriate answer from the options given below:

[4 Marks]

(A) (A), (B) and (E) only

(B) (A), (B) and (D) only

(C) (B), (C) and (E) only

(D) (A), (C) and (D) only

Explanation:

In the given statements, statement (i), (ii) and (iv) are correct. Statements (iii), and (v) are incorrect. The correct statements are, Bone marrow is the site of production of blood cell and tendons attach

bones to muscles.

Question 168.

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

[4 Marks]

(A) No radioactive sulfur in bacterial cells

(B) Radioactive phosphorus in bacterial cells

(C) Radioactive sulfur in bacterial cells

(D) Both radioactive sulfur and phosphorus in bacterial cells

Explanation:

Alfred Hershey and Martha Chase used radioactive phosphorus for DNA and radioactive sulfur for protein for their experiment. But in the given question sulphur is considered for DNA and phosphorous is considered for proteins. So radioactive sulphur will be found in bacterial cell.

Question 169.

Select the incorrect statements with respect to Cyclostomes.

(A) They lack scales and paired fins.

(B) They have circular mouth with jaws.

(C) They bear 6-15 pairs of gills.

(D) They migrate to deep sea for spawning.

Choose the most appropriate answer from the options given below:

[4 Marks]

(A) (B) and (D) only

(B) (A) and (D) only

(C) (B) and (C) only

(D) (A) and (B) only

Explanation:

In the given statements, statement (i) and (iii) are correct and statements (ii) and (iv) are incorrect. The correct statements are cyclostomes have a circular mouth without jaws and they migrate from marine water to fresh water for spawning respectively.

Question 170.

A unique vascular connection between the digestive tract and liver is called:

[4 Marks]

(A) Renal portal system

(B) Hepato-cystic system

(C) Hepato-pancreatic system

(D) Hepatic portal system

Explanation:

Unique vascular connection between the digestive tract and liver is called Hepatic portal system.

Question 171.

Milk of transgenic 'Cow Rosie' was nutritionally more balanced product for human babies than natural cow milk because it contained:

[4 Marks]

(A) Human alpha-lactalbumin

(B) Human insulin-like growth factor

(C) Human enzyme Adenosine Deaminase (ADA)

(D) Human protein a-1-antitrypsin

Explanation:

Cow Rosie was a transgenic animal and was first transgenic cow. This cow was able to produce human protein enriched milk. This milk contains the human alpha-lactalbumin and was a complete product for human infants than non-transgenic cow milk.

Question 172.

Gout is a type of disorder which leads to:

[4 Marks]

(A) Weakening of bones due to low calcium level

(B) Weakening of bones due to decreased bone mass

(C) Inflammation of joints due to cartilage degeneration

(D) Inflammation of joints due to accumulation of uric acid crystals

Explanation:

Gout is a disorder of joints caused due to the collection of uric acid crystals in the joints. This causes inflammation of the joints.

Question 173.

Which of the following methods is not commonly used for introducing foreign DNA into the plant cell?

[4 Marks]

(A) Agrobacterium mediated transformation

(B) Bacteriophages

(C) Gene gun

(D) 'Disarmed pathogen' vectors

Explanation:

Bacteriophage is a vector useful for transfer of viral DNA into the bacterial cell. It is not used for the transfer of foreign DNA in a plant cell.

Question 174.

Given below are two statements:

Statement I: Amino acids have a property of ionizable nature of $-NH_2$ and -COOH groups, hence have different structures at different pH.

Statement II: Amino acids can exist as Zwitterionic form at acidic and basic pH. In the light of the above statements, choose the most appropriate answer from the options given below:

[4 Marks]

(A) Statement I is incorrect but Statement II is correct

(B) Both Statement I and Statement II are correct

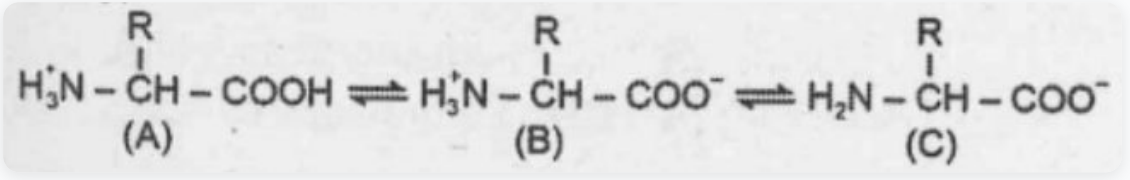
(C) Statement I is correct but Statement II is incorrect

(D) Both Statement I and Statement II are incorrect

Explanation:

Ionizable nature is a particular characteristic of $-NH_2$ and -COOH groups. In a solution containing different pH, the structure of amino acid is expected to change. Amino acid in a dipolar ionic form is called zwitterion. For a particular amino acid there exists an isoelectric point at which the net charge on amino acid becomes zero.

Here, in the given figure, (B) is a zwitterion.



Question 175.

Given below are two statements one is labelled as Assertion (A) and the other is labelled as Reason (R). Assertion (A): Spirulina is a microbe that can be used for reducing environmental pollution.

Reason (R): Spirulina is a rich source of protein, carbohydrates, fats, minerals and vitamins.

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

[4 Marks]

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

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

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

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

Explanation:

Spirulina can be grown easily on waste water consisting of starch, straw, animal manure or on sewage. This helps in the reduction of biodegradable pollutants from the environment and also beneficial for the growth of *Spirulina* on a large scale. *Spirulina* is a rich source of proteins, fats, minerals, carbohydrates and vitamins.

Question 176.

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

[4 Marks]

(A) Metaphase chromosomes are made up of four sister chromatids held together by centromere

(B) Complete disintegration of nuclear envelope takes place

(C) Chromosomes lie at the equator of the cell

(D) Chromosomes are highly condensed

Explanation:

During the metaphase stage of the cell cycle. Each chromosome has only two chromatids that are linked together by a centromere. The four chromatids can never be found in a cell cycle.

Question 177.

Against the codon 5' UAC 3', what would be the sequence of anticodon on tRNA?

[4 Marks]

(A) 5' ATG 3'

(B) 5' AUG 3'

(C) 5' GTA 3'

(D) 5' GUA 3'

Explanation:

The codons present on mRNA are complimentary to the anticodons of tRNA. The codon 5'-UAC-3' the expected anticodon will be 3'-AUG-5'.

Question 178.

Arrange the following formed elements in the decreasing order of their abundance in blood in humans:
(A) Platelets

(B) Neutrophils

(C) Erythrocytes

(D) Eosinophils

(E) Monocytes

Choose the most appropriate answer from the options given below:

[4 Marks]

(A) (C), (A), (B), (E), (D)

(B) (C), (B), (A), (E), (D)

(C) (A), (C), (B), (D), (E)

(D) (D), (E), (B), (A), (C)

Explanation:

For a healthy adult human male on an average:

- **Erythrocytes:** 5 millions to 5.5 millions of RBCs(erythrocytes) mm-3 of blood.
- **Platelets:** Blood normally contains 1,50,000–3,50,000 platelets mm-3.
- **Neutrophils:** Neutrophils form 60-65% of the total WBCs.
- **Monocytes:** Monocytes form 6-8% of the total WBCs.
- **Eosinophils:** Eosinophils form 2-3% of the total WBCs.

Thus, according to their relative abundance in blood the decreasing order of the formed elements in the blood:

Erythrocytes - Platelets - Neutrophils - Monocytes- Eosinophils

Question 179.

Which of the following are true about the taxonomical aid 'key'?

(A) Keys are based on the similarities and dissimilarities.

(B) Key is analytical in nature.

(C) Keys are based on the contrasting characters in pair called Couplet.

(D) Same key can be used for all taxonomic categories.

(E) Each statement in the key is called Lead.

Choose the most appropriate answer from the options given below:

[4 Marks]

(A) (A), (C), (D) and (E) only

(B) (A), (B) and (C) only

(C) (B), (C) and (D) only

(D) (A), (B), (C) and (E) only

Explanation:

Key can be defined as a taxonomical aid that can be used for the purpose of identification of organisms including plants and animals. The identification process is based on analysis of the similarities and dissimilarities between organisms. In this process, the contrasting characters appear in a pair called couplet. Each and every statement described in a key is called a lead. Separate key is used for describing each taxonomic category like family, genus and species required for the purpose of identification. These keys are analytical.

Question 180.

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

(a) Haemophilic son and haemophilic daughter.

(b) Haemophilic son and carrier daughter.

(c) Normal daughter and normal son.

(d) Normal son and haemophilic daughter.

Choose the most appropriate answer from the options given below:

[4 Marks]

(A) (b) and (c) only

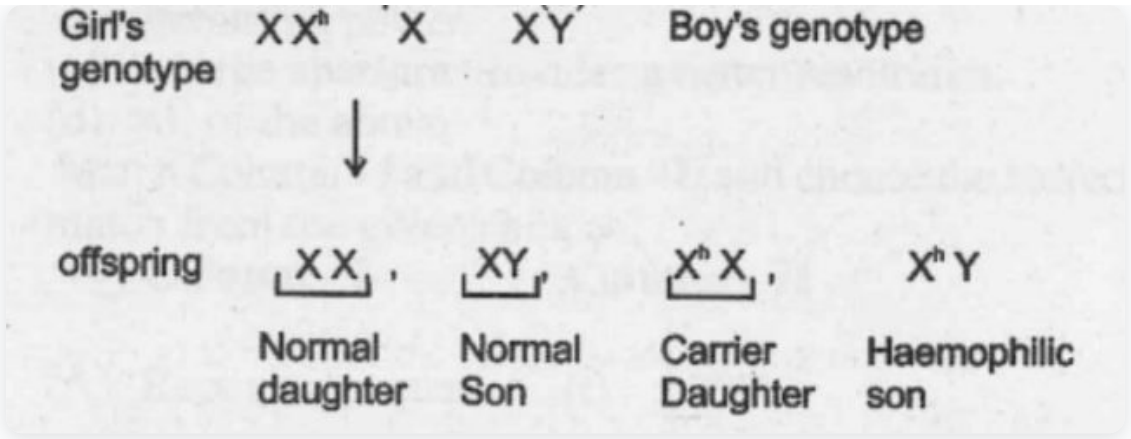
(B) (a) and (b) only

(C) (a) and (d) only

(D) (b) and (d) only

Explanation:

If a mother is heterozygous (a carrier) for haemophilia and father is normal and not affected by the disorder then each son will have a 1 in 2 (50%) chances of getting his mother's haemophilic allele and get affected by haemophilia. Each daughter has a 1 in 2 (50%) chances of getting her mother's haemophilic allele and being heterozygous carrier of the disease.



Question 181.

In the enzyme which catalyses the breakdown of: $H_2O_2 \rightarrow H_2O + O_2$, the prosthetic group is:

[4 Marks]

(A) Haem

(B) Nicotinamide adenine dinucleotide

(C) Niacin

(D) Zinc

Explanation:

Peroxidase is the catalytic enzyme that facilitate the breakdown of hydrogen peroxide into water and oxygen. Haem is the catalytic group of this enzyme.

Question 182.

Select the incorrect statement with respect to inbreeding of animals.

[4 Marks]

(A) It is used for evolving pure lines in cattle.

(B) It decreases homozygosity.

(C) It exposes harmful recessive genes that are eliminated by selection.

(D) It helps in accumulation of superior genes and elimination of less desirable genes.

Explanation:

Inbreeding involves mating between closely related individuals belonging to the same species upto 4-6 generations. This process will increase the homozygosity.

Question 183.

IUDs are small objects made up of plastic or copper that are inserted in the uterine cavity.

Which of the following statements are correct about IUDs?

(A) IUDs decrease phagocytosis of sperm within the uterus.

(B) The released copper ions suppress the sperm motility.

(C) IUDs do not make the cervix hostile to the sperm.

(D) IUDs suppress the fertilization capacity of sperm.

(E) The IUDs require surgical intervention for their insertion in the uterine cavity.

Choose the most appropriate answer from the options given below:

[4 Marks]

(A) (B) and (D) only

(B) (B) and (C) only

(C) (D) only

(D) (A), (D) and (E) only

Explanation:

Copper releasing IUD suppresses the motility of the sperms and also reduces the fertilising ability of the sperms.

Question 184.

Select the correct statement regarding mutation theory of evolution.

[4 Marks]

(A) This theory was proposed by Alfred Wallace

(B) Large differences due to mutations arise gradually in a population

(C) Single step large mutation is a cause of speciation

(D) Variations are small directional changes

Explanation:

Hugo de Vries, based on his experimental work on evening primrose proposed the idea of mutations. According to deVries mutation causes speciation and hence called it saltation (Single step large mutation).

Question 185.

Excretion in cockroach is performed by all, EXCEPT:

[4 Marks]

(A) Fat body

(B) Hepatic caeca

(C) Malpighian tubules

(D) Urecose glands

Explanation:

Hepatic caeca can be defined as the ring of 6-8 tubules. It is present at the junction of foregut and midgut of cockroach. It is responsible for secretion of digestive juices in the cockroach. Hepatic caeca has no role in the excretion process. Urecose glands is involved in the excretion process of the male cockroach. Malpighian tubules and fat bodies are excretory structures in both male and female cockroach.

Question 186.

Select the correct statements.

(A) Angiotensin II activates the cortex of adrenal gland to release aldosterone.

(B) Aldosterone leads to increase in blood pressure.

(C) ANF acts as a check on renin-angiotensin mechanism.

(D) ADH causes vasodilation.

(E) Vasopressin is released from adenohypophysis.

Choose the most appropriate answer from the options given below:

[4 Marks]

(A) (A), (B) and (E) only

(B) (A), (B) and (C) only

(C) (C), (D) and (E) only

(D) (B), (C) and (D) only

Explanation:

Angiotensin II causes the activation of the adrenal cortex of adrenal gland to release aldosterone hormone. Aldosterone causes an increase in the blood volume resulting in increase in blood pressure by increasing reabsorption of water and electrolytes from distal parts of nephron in the kidney. ANF causes vasodilation and decreases blood pressure and glomerular filtration rate (GFR).

Question 187.

If A and C make 30% and 20% of DNA, respectively, what will be the percentage composition of T and G?

[4 Marks]

(A) T: 20%, G: 30%

(B) T: 30%, G: 20%

(C) T: 30%, G: 30%

(D) T: 20%, G: 20%

Explanation:

According to Chargaff's rule, the amount of Adenine (A) will be always equal to Thymine and the amount of Cytosine (C) will always be equal to that Guanine (G). So,

A=T=30%+30%=60%

C=G=20%+20%=40%

So, T and G will be 30% and 20% respectively,

Question 188.

Refer to the following statements for agarose-gel electrophoresis:

(A) Agarose is a natural polymer obtained from sea-weed.

(B) The separation of DNA molecules in agarose-gel electrophoresis depends on the size of DNA.

(C) The DNA migrates from negatively-charged electrode to the positively-charged electrode.

(D) The DNA migrates from positively-charged electrode to the negatively-charged electrode.

Choose the most appropriate answer from the options given below:

[4 Marks]

(A) (A), (B) and (C) only

(B) (A) and (B) only

(C) (A), (B) and (D) only

(D) (A), (B) and (D) only

Explanation:

The matrix used for the purpose of gel electrophoresis is agarose gel. It is obtained from natural polymer extracted from the sea weeds. In agarose gel electrophoresis, the fragments of DNA separate according to the size resulting due to the sieving effect produced by the agarose gel. As DNA fragments are negatively charged molecules, they migrate towards the anode (positively charged electrode) under the influence of an electric field through a matrix.

Question 189.

Match List - I with List - II:

Choose the correct answer from the options given below:

[4 Marks]

List – I	List – 11
(A) Multipolar	(i) Somatic neural neuron system
(B) Bipolar neuron	(ii) Cerebral cortex
(C) Myelinated	(iii) Retina of Eye nerve fibre
(D) Unmyelinated	(iv) Spinal nerves nerve fibre

(A) (A)-(iii), (B)-(i), (C)-(iv), (D)-(ii)

(B) (A)-(ii), (B)-(iii), (C)-(iv), (D)-(i)

(C) (A)-(ii), (B)-(iii), (C)-(i), (D)-(iv)

(D) (A)-(ii), (B)-(iv), (C)-(iii), (D)-(i)

Explanation:

(a) Multipolar neurons are a part of the cerebral cortex.

(b) Bipolar neurons can be found in the retina of the eye.

(c) Myelinated nerve fibres can be found in spinal nerves.

(d) Unmyelinated nerve fibres can be found in the somatic neural systems.

Question 190.

Match List - I with List II:

Choose the correct answer from the options given below:

[4 Marks]

List - I	List - 11
(A) Cellular barrier	(i) Interferons
(B) Cytokine barrier	(ii) Mucus
(C) Physical barrier	(iii) Neutrophils
(D) Physiological	(iv) HCI in gastric barrier juice

(A) (A)-(ii), (B)-(iii), (C)-(iv), (D)-(i)

(B) (A)-(iii), (B)-(i), (C)-(ii), (D)-(iv)

(C) (A)-(iii), (B)-(iv), (C)-(ii), (D)-(i)

(D) (A)-(ii), (B)-(iii), (C)-(i), (D)-(iv)

Explanation:

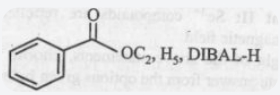
Cellular barriers include neutrophils. Cytokine barriers include interferons. Physical barriers include mucus membranes. Physiological barriers include HCl in gastric juice.

Question 191.

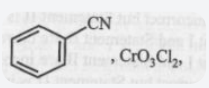
The incorrect method to synthesize benzaldehyde is:

[5 Marks]

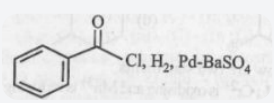
(A)



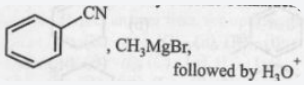
(B)



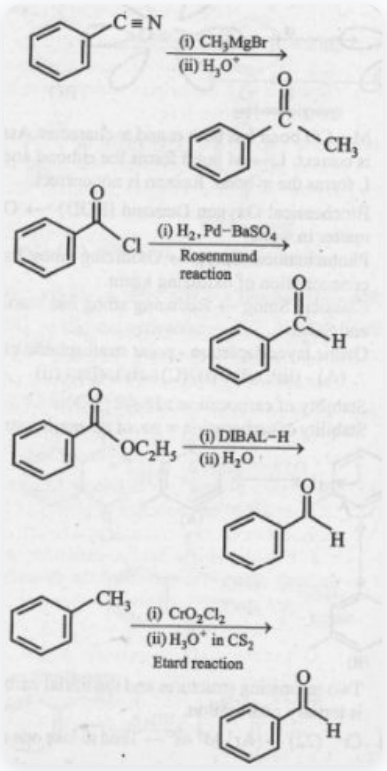
(C)



(D)



Explanation:

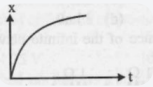


Question 192.

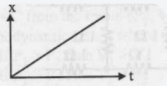
The position-time (x-t) graph for positive acceleration is

[4 Marks]

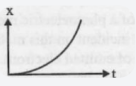
(A)



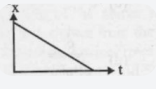
(B)



(C)

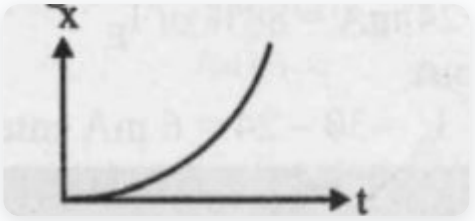


(D)



Explanation:

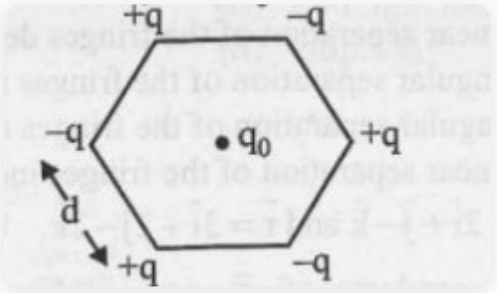
For + ve acceleration, dv/dt > 0 so, velocity is increasing therefore, slop of x-t graph is increasing and graph is as shown in figure



Question 193.

Six charges +q, -q, +q, -q +q and -q are fixed at the corners of a hexagon of side d as shown in the figure. The work done in bringing a charge q_0 to the centre of the hexagon from infinity is: (ε_0 - permittivity of free space)

[4 Marks]



(A) $-q^2/(4\pi\varepsilon_0 d)\ (3 - 1/\sqrt{2})$

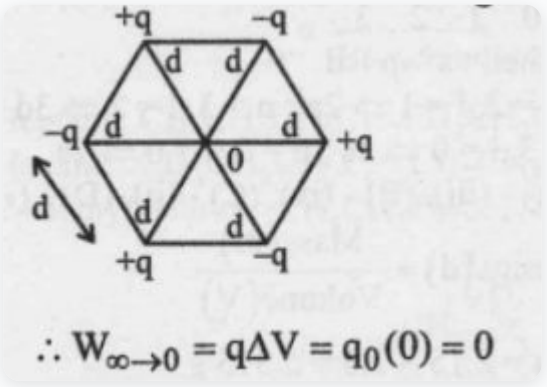
(B) $-q^2/(4\pi\varepsilon_0 d)$

(C) $-q^2/(4\pi\varepsilon_0 d)\ (6 - 1/\sqrt{2})$

(D) Zero

Explanation:

Potential at the centre of hexagon is zero i.e., V _0 = 0

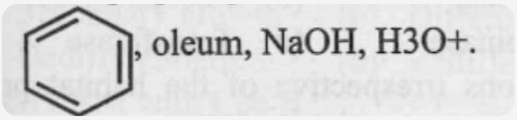


Question 194.

Which one of the following reaction sequence is incorrect method to prepare phenol?

[4 Marks]

(A)



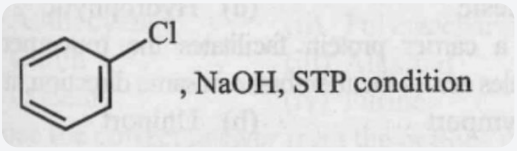
(B)

Aniline, NaNO2 + HCl, H2O, heating

(C)

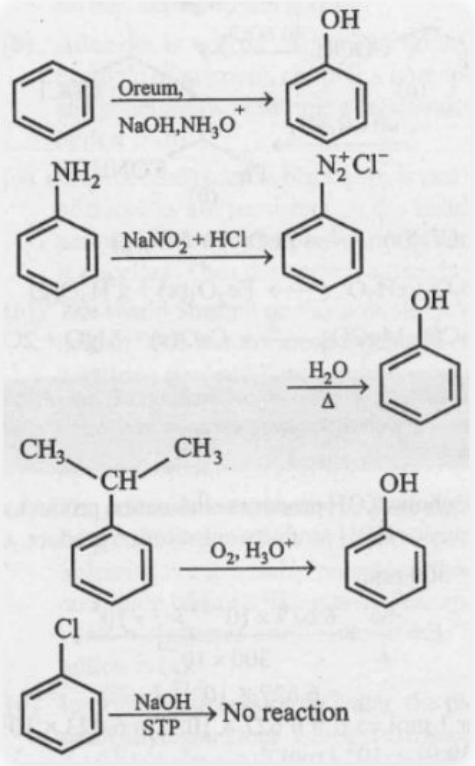
Cumene, O2, H3O+

(D)



Explanation:

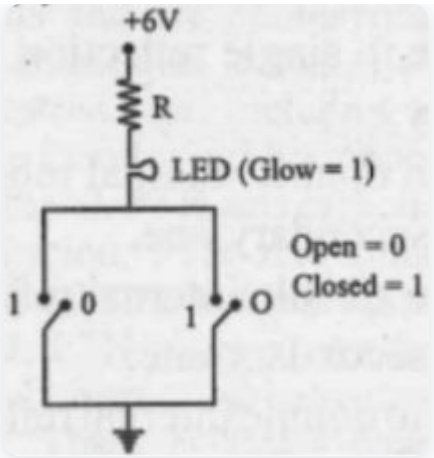
Potential at the centre of hexagon is zero i.e., Vo =0



Question 195.

Identify the equivalent logic gate represented by the given circuit:

[4 Marks]



(A) OR

(B) NAND

(C) NOR

(D) AND

Explanation:

When both inputs are given as "0", means open circuit, and no current flows through the LED. If the inputs given as 0,1 & 1,0 & 1,1 current flows through the LED. Hence the equivalent logic gate is "OR" gate.

The truth table for the given logic gate circuit.

Input		Output
A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

Question 196.

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

[4 Marks]

(A) Zener voltage remains constant at breakdown

(B) p and n regions of zener diode are heavily doped

(C) It is designed to operate under reverse bias

(D) Depletion region formed is very wide

Explanation:

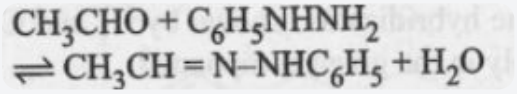
Zener diode is fabricated by heavily doping both p and N- sides of the junction. Due to this, the depletion region formed is very thin.

Question 197.

Which of the following reactions is not an example for nucleophilic addition - elimination reaction?

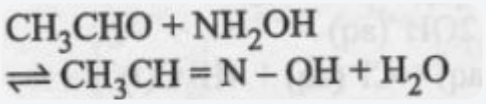
[4 Marks]

(A)



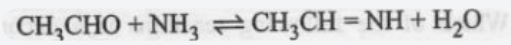
$$CH_3CHO + C_6H_5NHNH_2 \rightleftharpoons CH_3CH = N\text{–}NHC_6H_5 + H_2O$$

(B)



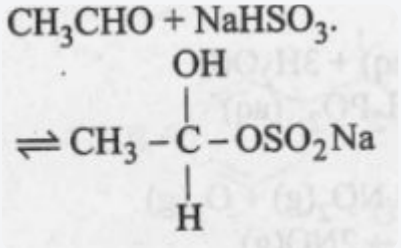
$$CH_3CHO + NH_2OH \rightleftharpoons CH_3CH = N - OH + H_2O$$

(C)



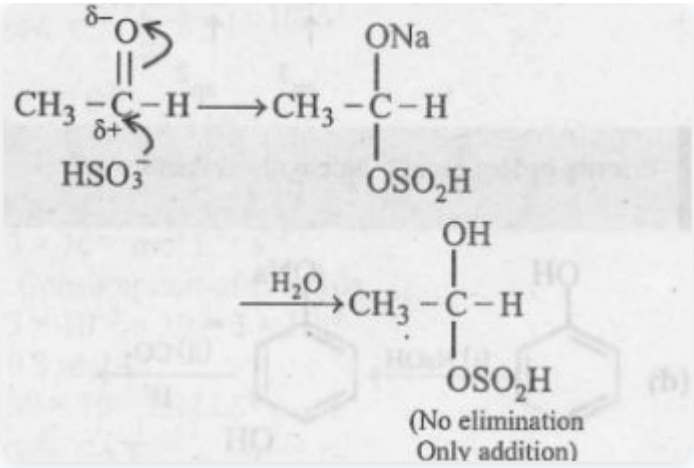
$$CH_3CHO + NH_3 \rightleftharpoons CH_3CH = NH + H_2O$$

(D)



$$CH_3CHO + NaHSO_3. \rightleftharpoons CH_3 - \underset{H}{\overset{OH}{C}} - OSO_2Na$$

Explanation:



Question 198.

Flourine is a stronger oxidising agent than chlorine because:

(A) F-F bond has a low enthalpy of dissociation.

(B) Flouride ion (F^-) has high hydration enthalpy.

(C) Electron gain enthalpy of flourine is less negative than chlorine.

(D) Flourine has a very small size.

Choose the most appropriate answer from the options given:

[4 Marks]

(A) (A) and (C) only

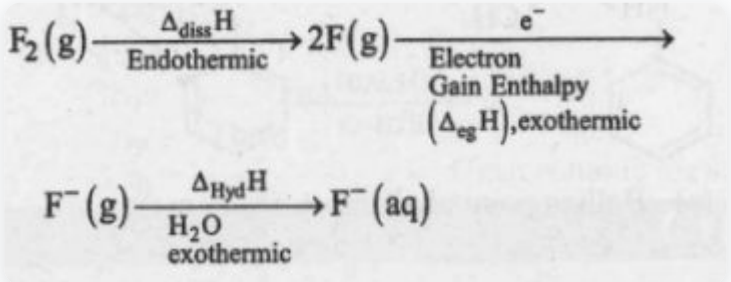
(B) (A) and (B) only

(C) (B) and (C) only

(D) (A) and (D) only

Explanation:

F_2 has lower Δ_diss H than theoratically expected and high Δ_hyd H, which are favourable conditions for generating $F^-(aq)$.



Question 199.

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

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

[4 Marks]

gas	K_H/k bar
Ar	40.3
CO_2	1.67
HCHO	1.83×10^{-5}
CH_4	0.413

(A) HCHO < CO_2 < CH_4 < Ar

(B) Ar < CH_4 < CO_2 < HCHO

(C) Ar < CO_2 < CH_4 < HCHO

(D) HCHO < CH_4 < CO_2 < Ar

Explanation:

Higher the value K_H, lower is the solubility of gas, Correct order: HCHO>CH_4>CO_2>Ar

Question 200.

DNA polymorphism forms the basis of:

[4 Marks]

(A) Translation

(B) DNA finger printing

(C) Genetic mapping

(D) Both genetic mapping and DNA finger printing

Explanation:

DNA polymorphism form the basis of genetic mapping and DNA fingerprinting.