CBSE EXAMINATION PAPER-2020

NEET-ZOOLOGY

(Solved)

Time allowed : 3 hours | Maximum Marks : 719

General Instructions :

Read the following instructions carefully and follow them :

i. This question paper contains **180 questions.** All questions are **compulsory.**

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

iii. **Section A** – questions number **1 to 180** 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 intrinsic semiconductor is converted into n-type extrinsic semiconductor by doping it with

[4 Marks]

(A) Phosphorous

(B) Aluminium

(C) Germanium

(D) Silver

Explanation:

n type semiconductors are obtained by adding a pentavalent impurity (like phosphorous) with intrinsic semiconductor.

Question 2. The half life of a radioactive sample undergoing α-decay is 1.4×10^{17} s. If the number of nuclei in the sample is 2.0×10^{21}, the activity of the sample is nearly

[4 Marks]

(A) 10^3 Bq

(B) 10^4 Bq

(C) 10^5 Bq

(D) 10^8 Bq

Explanation: Given, Halflife of radioactive sample, $T_1/_2 = 1.4 \times 10^{17}$ s Number of nuclei in the sample, $N = 2.0 \times 10^{21}$ Half life, $T_1/_2 = 0.693 / \lambda$ Here, λ = disintegration constant $\therefore \lambda = 0.693 / T_1/_2$ Activity of the sample = $\lambda N = (0.693 / T_1/_2) \times 2 \times 10^{21} = (0.693 / 1.4 \times 10^{17}) \times 2 \times 10^{21} = 0.99 \times 10^4$ Bq ≈ 1×10^4 Bq = 10^4 Bq

Question 3.

The E.M. wave with shortest wavelength among the following is,

[4 Marks]

(A) X-rays

(B) Ultraviolet rays

(C) Microwaves

(D) Gamma rays

Explanation:

The increasing order of wavelength of electromagnetic wave is as follows - λ_γ-rays < λ_x-rays < λ_infrared < λ_microwave < λ_radiowave Clearly, γ-rays has shortest wavelength.

Question 4.

A wheel with 20 metallic spokes each 1 m long is rotated with a speed of 120 rpm in a plane perpendicular to a magnetic field of 0.4 G. The induced emf between the axle and rim of the wheel will be (1 G = 10^{-4} T)

[4 Marks]

(A) 4.0×10^{-5} V

(B) 2.51 × 10^{-4} V

(C) 2.51 × 10^{-5} V

(D) 2.51 V

Explanation:

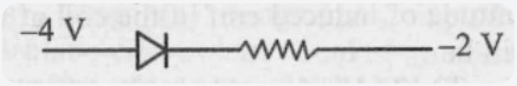
Given, Magnetic field, B = 0.4 G = 0.4 × 10^{-4} T Length of each metallic spoke, l = 1 m Frequency of revolution, f = 12 rpm = 120 / 60 rps = 2 Hz Emf induced between the axle and rim of the wheel is e = 1/2 Bωl^2 = 1/2 B(2πf)l^2 = πBfl^2 = 3.14 × 0.4 × 10^{-4} × 2 × 1^2 = 2.51 × 10^{-4} V

Question 5.

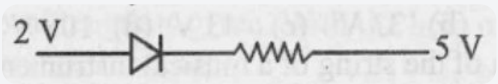
Out of the following which one is a forward biased diode?

[4 Marks]

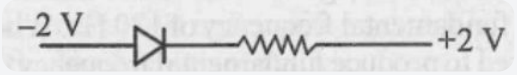
(A)



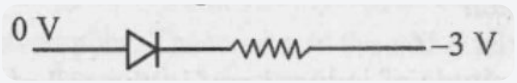
(B)



(C)



(D)



Explanation:

A p-n junction diode is in forward biased when p-side is at higher potential than n-side. Since, O(V) > −3V. Hence in option diode circuit is in forward biased.

Question 6. Two solid conductors are made up of same material, have same length and same resistance. One of them has a circular cross section of area A_1 and the other one has a square cross section of area A_2. The ratio A_1/A_2 is

[4 Marks]

(A) 2

(B) 1.5

(C) 1

(D) 0.8

Explanation: Let l_1 and l_2 be the lengths of two solid conductors. We have given $l_1 = l_2$. Resistance, $R = \rho \cdot l/A \Rightarrow R \propto l/A \therefore R_1/R_2 = l_1/l_2 \cdot A_2/A_1 \Rightarrow R_1/R_1 = l_1/l_1 \cdot A_2/A_1 \Rightarrow 1 = A_2/A_1$ [$\because R_1 = R_2$ and $l_1 = l_2$] $\Rightarrow A_1/A_2 = 1$

Question 7.

Two coherent sources of light interfere and produce fringe pattern on a screen. For central maximum, the phase difference between the two waves will be,

[4 Marks]

(A) π

(B) 3π/2

(C) π/2

(D) Zero

Explanation:

For central maximum, path difference between the interfering waves meeting on the screen is zero. ∴ Phase difference = 2π/λ × path difference = 2π/λ × 0 = 0

Question 8.

Time intervals measured by a clock give the following readings : 1.25 s, 1.24 s, 1.27 s, 1.21 s and 1.28 s What is the percentage relative error of the observations?

[4 Marks]

(A) 16%

(B) 4%

(C) 1.6%

(D) 2%

Explanation:

Average value of time interval $\bar{T} = (1.25 + 1.24 + 1.27 + 1.21 + 1.28) / 5 = 625 / 5$ s = 1.25 s Absolute errors in the measured values of time intervals are $|\Delta T_1| = |1.25 - 1.25| = 0$ $|\Delta T_2| = |1.25 - 1.24| = 0.01$ $|\Delta T_3| = |1.25 - 1.27| = 0.02$ $|\Delta T_4| = |1.25 - 1.21| = 0.04$ $|\Delta T_5| = |1.25 - 1.28| = 0.03$ Mean

absolute error, $\Delta\bar{T} = (|\Delta T_1| + |\Delta T_2| + |\Delta T_3| + |\Delta T_4| + |\Delta T_5|) / 5 = (0 + 0.01 + 0.02 + 0.04 + 0.03) / 5 = 0.1 / 5 = 0.02$ s ∴ Percentage relative error = $\Delta\bar{T} / \bar{T} \times 100 = 0.02 / 1.25 \times 100 = 1.6\%$.

Question 9.

An ideal gas equation can be written as $P = \rho RT / M_0$ where ρ and M_0 are respectively,

[4 Marks]

(A) Mass density, molar mass

(B) Mass density, mass of the gas

(C) Number density, Molar mass

(D) Number density, mass of the gas

Explanation:

Ideal gas equation is given by, PV = nRT Here, P = pressure of the ideal gas V = Volume of the ideal gas R = universal gas constant T = Temperature n = no. of moles of gas ∴ $P = 1/V\ nRT = 1/V\ (m/M_0)$ RT (∵ $n = m/M_0$)

$= (m/V)\ RT / M_0 = \rho RT / M_0$

ρ = m/V = mass density
M_0 = Molar mass

Question 10.

The magnetic field in a plane electromagnetic wave is given by, $B_y = 2\times10^{-7} \sin(\pi\times10^3 x + 3\pi\times10^{11} t)$T Calculate the wavelength.

[4 Marks]

(A) 2×10^3 m

(B) 2×10^{-3} m

(C) $\pi\times10^{-3}$ m

(D) $\pi\times10^3$ m

Explanation:

Magnetic field in plane electromagnetic wave is given as $B_y = 2 \times 10^{-7} \sin(\pi \times 10^3 x + 3\pi \times 10^{11} t)$ T Comparing with general equation of electromagnetic wave, $B_y = B_0 \sin(kx - \omega t)$, we get $k = \pi \times 10^3$ $A = 2 \times 10^{-7}$ We know that wave number, $k = 2\pi/\lambda = \pi \times 10^3 \Rightarrow \lambda = 2/10^3 = 2 \times 10^{-3}$ m

Question 11.

A barometer is constructed using a liquid (density = 760 kg/m³). What would be the height of the liquid column, when a mercury barometer reads 76 cm? (density of mercury = 13600 kg/m³)

[4 Marks]

(A) 13.6 m

(B) 1.36 m

(C) 0.76 m

(D) 136 m

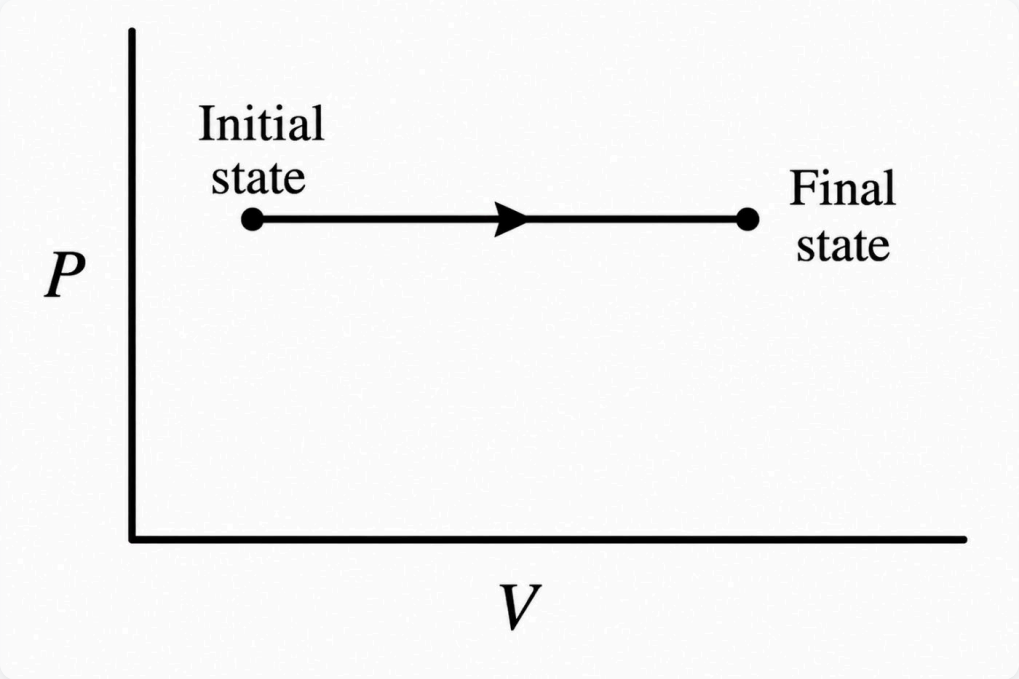
Explanation:

Density of liquid, ρ_m = 760 kg/m³ Density of mercury, ρ_m = 13600 kg/m³ Height of liquid column in mercury barometer, h_m = 76 cm = 0.76 m Let h_l be the height of liquid in liquid column, then according to given condition p_liquid = p_mercury ⇒ h_l ρ_l g = h_m ρ_m g ⇒ h_l = h_m ρ_m / ρ_l = 0.76 × 13600 / 760 = 13.6 m

Question 12.

The P-V diagram for an ideal gas in a piston cylinder assembly undergoing a thermodynamic process is shown in the figure.

[4 Marks]



(A) isotherma

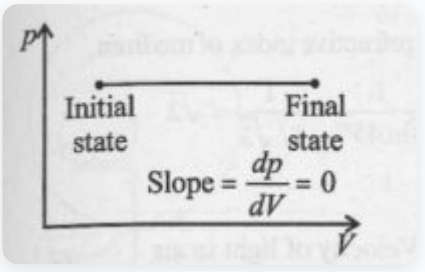
(B) adiabatic

(C) isobaric

(D) isochoric

Explanation:

The given graph represents isobaric expansion. From the graph, it is clear pressure of ideal gas in the piston cylinder is constant. Thus, the process is isobaric.



Question 13. The efficiency of a Carnot engine depends upon

[4 Marks]

(A) the temperature of the source only

(B) the temperature of the sink only

(C) the temperatures of the source and sink

(D) the volume of the cylinder of the engine

Explanation: Efficiency of Carnot's heat engine is $\eta = 1 - T_2/T_1$ where, T_2 = temperature of sink and T_1 = temperature of source. Hence, η depends upon the temperature of source and sink both.

Question 14.

The electric field at a point on the equatorial plane at a distance r from the centre of a dipole having dipole moment p(vector) is given by, (r >> separation of two charges forming the dipole, ε_0 - permittivity of free space)

[4 Marks]

(A) $E(vector) = -P(vector) / 4\pi \varepsilon_0 r^2$

(B) $E(vector) = -2P(vector) / 4\pi \varepsilon_0 r^3$

(C) $E(vector) = -P(vector) / 4\pi \varepsilon_0 r^3$

(D) $E(vector) = P(vector) / 4\pi \varepsilon_0 r^3$

Explanation:

The magnitude of electric field at equatorial plane at a distance r from the centre of dipole is $E = 1 / 4\pi\varepsilon_0 \cdot p / (y^2 + r^2)^{3/2}$ Here, y = separation between two charges For r >> y

$E = 1 / 4\pi\varepsilon_0 \cdot P / r^3$

Question 15. A liquid does not wet the solid surface if angle of contact is

[4 Marks]

(A) equal to 45°

(B) zero

(C) greater than 90°

(D) equal to 60°

Explanation: If angle of contact is greater than 90°, then liquid does not wet the solid surface.

Question 16. Three stars A, B, C have surface temperatures T_A, T_B, T_C respectively. Star A appears bluish, star B appears reddish and star C yellowish. Hence,

[4 Marks]

(A) T_A > T_C > T_B

(B) T_A > T_B > T_C

(C) T_B > T_C > T_A

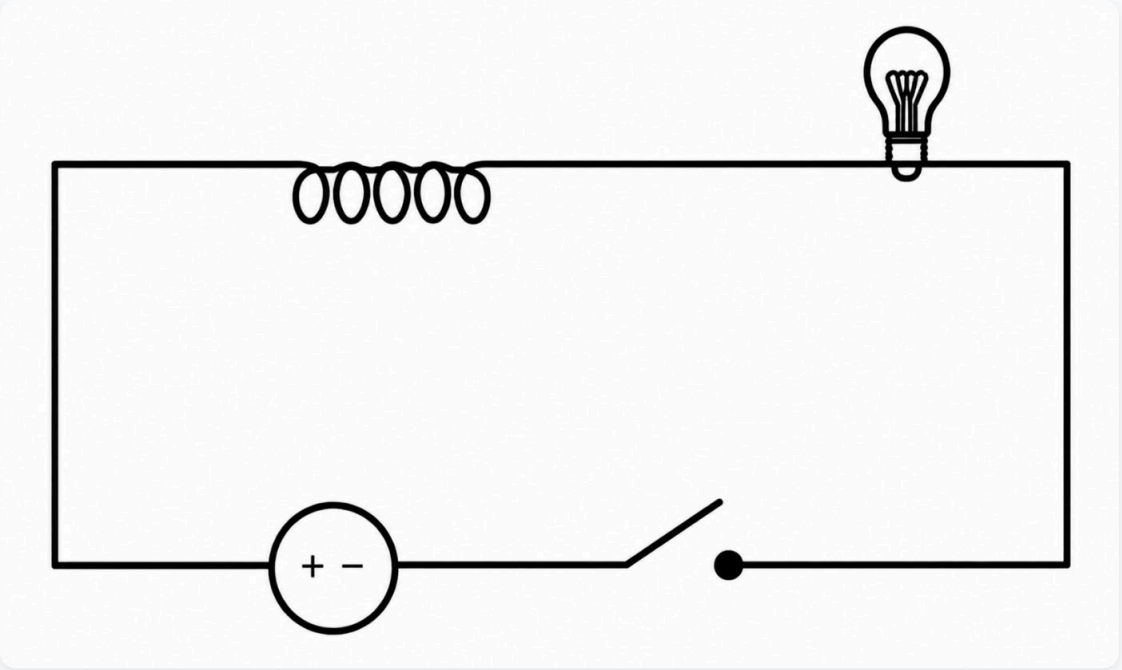
(D) T_C > T_B > T_A

Explanation: Wein's displacement law is given by $\lambda \propto b/T$ i.e., $\lambda \propto 1/T$ ...(i) We know that $\lambda_{bluish} < \lambda_{yellowish} < \lambda_{reddish}$ $\therefore \lambda_A < \lambda_C < \lambda_B$ ...(ii) Hence, using Eq. (i) and (ii) we have T_A > T_C > T_B

Question 17.

A light bulb and an inductor coil are connected to an ac source through a key as shown in the figure below. The key is closed and after sometime an iron rod is inserted into the interior of the inductor. The glow of the light bulb

[4 Marks]



(A) decreases

(B) will fluctuate

(C) remains unchanged

(D) increases

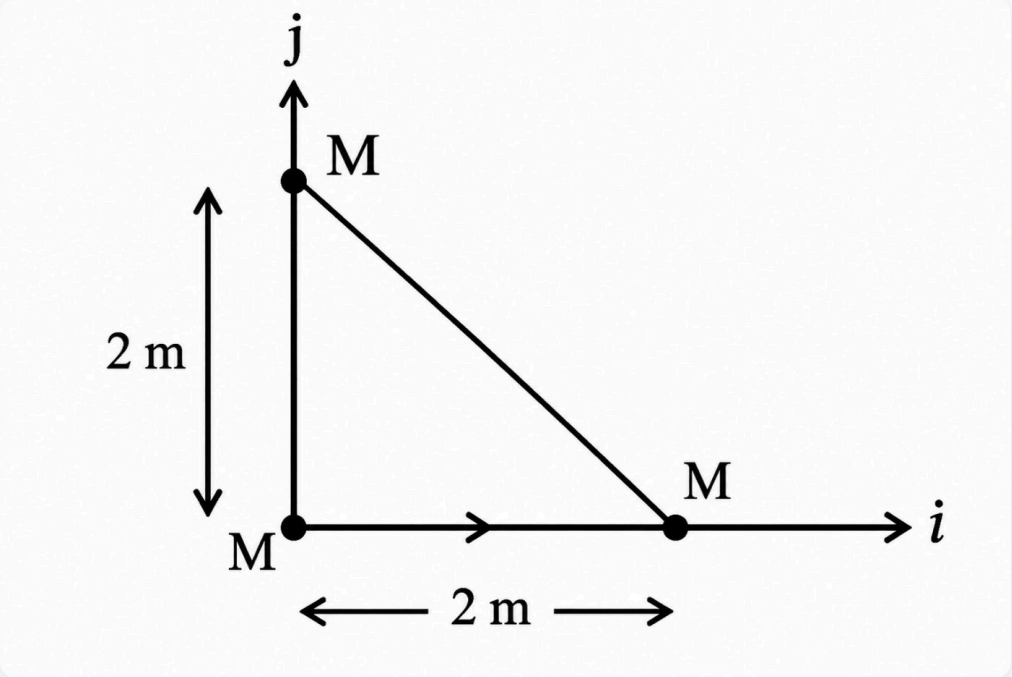
Explanation:

When an iron rod is inserted into the interior of the inductor, then inductance (L) of the coil increases. Hence, inductive reactance ($X_L = \omega L$) also increases. Current in the circuit containing inductor is given by $I = e / X_L = e / \omega L$ As inductive resistance of the inductor increases, current in the circuit decreases. Therefore, glow of the light bulb will decrease.

Question 18.

Three identical spheres, each of mass M, are placed at the corners of a right angle triangle with mutually perpendicular sides equal to 2 m (see figure). Taking the point of intersection of the two mutually perpendicular sides as the origin, find the position vector of centre of mass.

[4 Marks]



(A) (î + ĵ)

(B) 2/3 (î + ĵ)

(C) 4/3 (î + ĵ)

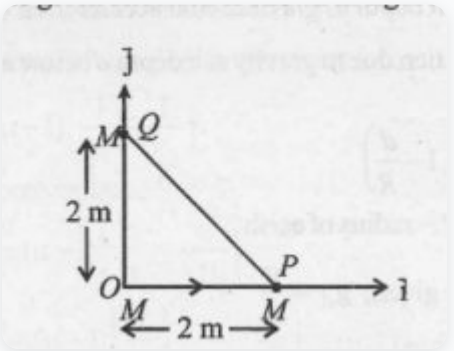
(D) 2(î + ĵ)

Explanation:

The given situation is shown in figure. The coordinates of centre of mass are X_COM = (M × 0 + M × 2 + M × 0) / 3M = 2/3

Y_COM = (M × 0 + M × 2 + M × 0) / 3M = 2/3

Position vector = 2/3 î + 2/3 ĵ



Question 19. The de Broglie wavelength of an electron moving with kinetic energy of 144 eV is nearly [4 Marks]

(A) 102 × 10^{-2} nm

(B) 10^{2} × 10^{-3} nm

(C) $10^2 \times 10^{-5}$ nm

(D) 102×10^{-4} nm

Explanation: Kinetic energy of electron = 144 eV Kintetic energy gained by electron under potential V is E = eV ∴ eV = 144 eV ⇒ V = 144 V de-Broglie wavelength, λ = 1.227/√V Å = 1.227/√144 Å = 1.227/12 Å = 0.102 Å = 1.02 nm = 102×10^{-2} nm.

Question 20.

The angle of 1' (minute of angle) in radian is nearly equal to

[4 Marks]

(A) 4.80×10^{-6} rad

(B) 4.85×10^{-4} rad

(C) 1.75×10^{-2} rad

(D) 2.91×10^{-4} rad

Explanation:

We know that 1 minute = 1/60 degree = 1/60 × π/180 rad (∵ 180 degree = π radian) = 2.91×10^{-4} rad.

Question 21.

The total energy of an electron in the n^{th} stationary orbit of the hydrogen atom can be obtained by

[4 Marks]

(A) $E_n = -1.36/n^2$ eV

(B) $E_n = -13.6/n^2$ eV

(C) $E_n = 13.6/n^2$ eV

(D) $E_n = -13.6 \times n^2$ eV

Explanation:

In a hydrogen atom, the energy of electron in n^{th} orbit is $E_n = -13.6/n^2$ eV

Question 22.

A wire of length L metre carrying a current of I Ampere is bent in the form of circle. Its magnetic moment is

[4 Marks]

(A) $2IL^2/\pi$ A m^2

(B) $I\pi L^2/4$ A m^2

(C) $IL^2/4$ A m^2

(D) $IL^2/4\pi$ A m^2

Explanation:

Let R be the radius of the circle, $L = 2\pi R \Rightarrow R = L/2\pi$ Area, $A = \pi R^2 = \pi L^2/4\pi^2 = L^2/4\pi \therefore$ Magnetic moment, $M = IA = IL^2/4\pi$ Am^2

Question 23.

What is the depth at which the value of acceleration due to gravity becomes 1/n times the value that at the surface of earth? (radius of earth = R)

[4 Marks]

(A) $Rn/(n - 1)$

(B) $R(n - 1)/n$

(C) R/n^2

(D) R/n

Explanation:

Let at depth d, gravitational acceleration becomes g/n Acceleration due to gravity at a depth d below earth surface is, $g_d = g(1 - d/R)$ where, R = radius of earth We have given, $g_d = g/n \Rightarrow g(1 - d/R) = g/n \Rightarrow 1 - d/R = 1/n \Rightarrow 1 - 1/n = d/R \Rightarrow (n - 1)/n = d/R \Rightarrow d = (n - 1)/n\ R$

Question 24.

An object is placed on the principal axis of a concave mirror at a distance of 1.5 f (f is the focal length). The image will be at,

[4 Marks]

(A) 1.5f

(B) −1.5f

(C) −3f

(D) 3f

Explanation:

From the new Cartesian sign convention, Object distance, u = −1.5f According to mirror formula, 1/v + 1/u = 1/f ⇒ 1/v + 1/(−1.5f) = 1/(−f) ⇒ 1/v = −1/f + 1/1.5f = 1/f [−1 + 1/1.5] = (−1.5 + 1)/1.5f ⇒ 1/v = 1/f (−1/3) ⇒ v = −3f

Question 25. The angular speed of the wheel of a vehicle is increased from 360 rpm to 1200 rpm in 14 second. Its angular acceleration is,

[4 Marks]

(A) 1 rad/s²

(B) 2π rad/s²

(C) 28π rad/s²

(D) 120π rad/s²

Explanation: Initial angular speed of wheel, $\omega_0 = 2\pi f_0 = 2\pi \times 360/60$ rad/s = 12π rad/s Final angular speed of wheel, $\omega = 2\pi f = 2\pi \times 1200/60$ rad/s = 40π rad/s Time taken, t = 14 s From the equation of rotational motion, $\omega = \omega_0 + \alpha t \Rightarrow \alpha = (\omega - \omega_0)/t \therefore \alpha = (40\pi - 12\pi)/14 = 28\pi/14 = 2\pi$ rad/s²

Question 26.

The acceleration of an electron due to the mutual attraction between the electron and a proton when they are 1.6 Å apart is, ($m_e = 9 \times 10^{-31}$ kg, $e = 1.6 \times 10^{-19}$ C) (Take $1/4\pi\varepsilon_0 = 9 \times 10^9$ Nm²C⁻²)

[4 Marks]

(A) 10^{25} m/s²

(B) 10^{22} m/s²

(C) 10^{23} m/s²

(D) 10^{24} m/s²

Explanation:

Force of mutual attraction between the electron and proton is $F = Ke^2/r^2$ (Here, $K = 9 \times 10^9$) $\Rightarrow F = 9 \times 10^9 \times e^2/r^2 = 9 \times 10^9 \times (1.6 \times 10^{-19})^2 / (1.6 \times 10^{-10})^2 = 9 \times 10^{-9}$ N $\therefore$ Acceleration of electron = $F/m_e = 9 \times 10^{-9} / 9 \times 10^{-31} = 10^{-9} \times 10^{31} = 10^{22}$ m/s²

Question 27. What happens to the mass number and atomic number of an element when it emits γ-radiation?

[4 Marks]

(A) Mass number increases by four and atomic number increases by two

(B) Mass number decreases by four and atomic number decreases by two

(C) Mass number and atomic number remain unchanged

(D) Mass number remains unchanged while atomic number decreases by one

Explanation: In gamma decay there is no change in atomic number and mass number.

Question 28.

If the critical angle for total internal reflection from a medium to vacuum is 45°, then velocity of light in the medium is,

[4 Marks]

(A) 3×10^8 m/s

(B) 1.5×10^8 m/s

(C) $3/\sqrt{2} \times 10^8$ m/s

(D) $\sqrt{2} \times 10^8$ m/s

Explanation:

Critical angle for total internal reflection, $i_c = 45°$ We know that refractive index of medium, $\mu = 1/\sin i_c = 1/\sin 45° = 1/(1/\sqrt{2}) = \sqrt{2}$ $\therefore \mu = \sqrt{2}$ Also, μ = Velocity of light in air / Velocity of light in medium = $\sqrt{2} \Rightarrow 3 \times 10^8 / v_m = \sqrt{2} \Rightarrow v_m = 3/\sqrt{2} \times 10^8$ m/s

Question 29.

A point mass 'm' is moved in a vertical circle of radius 'r' with the help of a string. The velocity of the mass is $\sqrt{7gr}$ at the lowest point. The tension in the string at the lowest point is

[4 Marks]

(A) 6 mg

(B) 1 mg

(C) 7 mg

(D) 8 mg

Explanation:

Velocity of point mass in vertical circle at lowest point, $v_t = \sqrt{7gr}$ $v_t = \sqrt{7gr} > \sqrt{5gr}$

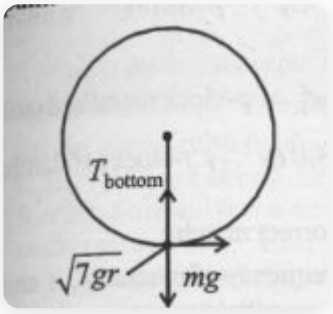
Hence, point mass will have completed the vertical circular path. At the lowest point m will act downward and tension in the upward direction,

$T_{bottom} - mg = mv^2/r$

$\Rightarrow T_{bottom} - mg = m/r\ (\sqrt{7gr})^2$

$\Rightarrow T_{bottom} - mg = 7mg$

$\Rightarrow T_{(bottom)} = 8mg$



Question 30. A plano-convex lens of unknown material and unknown focal length is given. With the help of a spherometer we can measure the,

[4 Marks]

(A) refractive index of the material

(B) radius of curvature of the curved surface

(C) focal length of the lens

(D) aperture of the lens

Explanation: Spherometer is used for precise measurement of the radius of curvature of a lens and curved mirrors and their principal aperture.

Question 31.

The power of a biconvex lens is 10 dioptre and the radius of curvature of each surface is 10 cm. Then the refractive index of the material of the lens is

[4 Marks]

(A) 4/3

(B) 3/2

(C) 5/3

(D) 9/8

Explanation:

Power of biconvex lens, P = 10D Focal length of biconvex lens, f = 1/P = 1/10 = 0.1 m = 10 cm According to lens Maker's formula, $1/f = (\mu - 1)(1/R_1 - 1/R_2)$ For biconvex lens, $R_1 = R$, $R_2 = -R$ ∴ $1/10 = (\mu - 1)(1/R - 1/-R) = (\mu - 1)(2/R)$ Given, R = 10 cm ∴ $1/10 = (\mu - 1)(2/10) \Rightarrow 1 = (\mu - 1) \times 2 \Rightarrow \mu - 1 = 1/2 \Rightarrow \mu = 1 + 1/2 = 3/2$

NOTES:

Lens Maker's Formula is given by:

$1/F=(\mu-1)(1/R_1-1/R_2)$

For a **biconvex lens**, $R_1=R$, $R_2= - R$

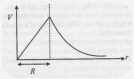
∴ $F=R/2(\mu-1)$

Question 32.

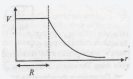
The variation of electrostatic potential with radial distance rfrom the centre of a positively charged metallic thin shell of radius R is given by the graph

[4 Marks]

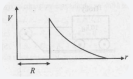
(A)



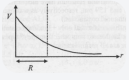
(B)



(C)



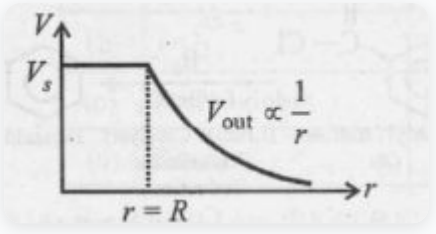
(D)



Explanation:

Inside the charged metallic thin shell electric potential remains constant and equal to the potential at the surface of spherical shell. Outside the spherical shell, $V \propto 1/r$

Hence, variation of potential (V) with distance given as



Question 33.

Which of the following gate is called universal gate?

[4 Marks]

(A) NAND gate

(B) AND gate

(C) OR gate

(D) NOT gate

Explanation:

NAND and NOR gate are called universal because all type of logic gates like the OR, the AND and the NOT can be realised with the help of NAND and NOR gate.

Question 34.

Identify the function which represents a periodic motion.

[4 Marks]

(A) sin ωt + cos ωt

(B) $\log_e(\omega t)$

(C) e^(ωt)

(D) e^(-ωt)

Explanation:

Sinωt and cosωt, both are periodic function of same angular frequency (ω) and period 2π/ω

As sum of two periodic functions is also a periodic function, hence sinωt + cosωt represents periodic motion.

Question 35. The wave nature of electrons was experimentally verified by,

[4 Marks]

(A) Davisson and Germer

(B) de Broglie

(C) Hertz

(D) Einstein

Explanation: Wave nature of electrons was experimentally verified byDavisson and German experiment.

Question 36.

A person sitting in the ground floor of a building notices through the window, of height 1.5 m, a ball dropped from the roof of the building crosses the window in 0.1 s. What is the velocity of the ball when it is at the top most point of the window? ($g = 10\ m/s^2$)

[4 Marks]

(A) 4.5 m/s

(B) 14.5 m/s

(C) 15.5 m/s

(D) 20 m/s

Explanation:

Time taken to cross the window, t = 0.1 s

Height of the window, h = 1.5 m

Let u be the velocity at the top most point of the window, then using $h = u\,t + 1/2\,g\,t^2$

$\Rightarrow 1.5 = u \times 0.1 + ½ \times 10 \times (0.1)^2$

$\Rightarrow 1.5 = 0.1u + 0.05$

$\Rightarrow u = 1.5 - 0.05 / 0.1 \Rightarrow 1.45 / 0.1 = 14.5\ m/s$

Question 37.

Which among the following salt solutions is basic in nature?

[3 Marks]

(A) Ammonium nitrate

(B) Ammonium sulphate

(C) Sodium acetate

(D) Ammonium chloride

Explanation:

Sodium acetate (CH_3COONa) is a salt of strong base (NaOH) and weak acid (CH_3COOH), therefore its salt solution is basic in nature.

Question 38.

If 8 g of a non-electrolyte solute is dissolved in 114 g of n-octane to reduce its vapour pressure of 80%, the molar mass (in g mol^{-1}) of the solute is [Given that molar mass of n-octane is 114 g mol^{-1}]

[4 Marks]

(A) 60

(B) 40

(C) 20

(D) 80

Explanation:

Assuming dilute solution (moles of solvent >>> moles of solute)

$\Rightarrow (P_1^0 - P_1)/P_1^0$ = Moles of solute / Moles of solvent

$\Rightarrow (P_1^0 - P_1)/P_1^0 = (W_2 \times M_1)/(M_2 \times W_1)$

$\because \Delta P = P_1^0 - P_1$ $\Delta P/P_1^0 = (W_2 \times M_1)/(M_2 \times W_1)$

Here W_1 and W_2 are the masses and M_1 and M_2 are the molar masses of solute and solvent respectively.

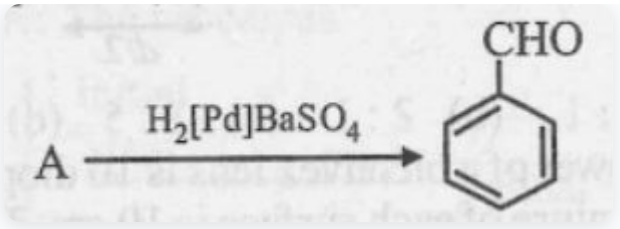
Now, $20/100 = (8/M_2) \times (114/114)$

$M_2 = (8 \times 100)/20 = 40$ g mol^{-1}

Question 39.

Identify compound (a) in the following reaction:

[4 Marks]



(A) Benzoyl chloride

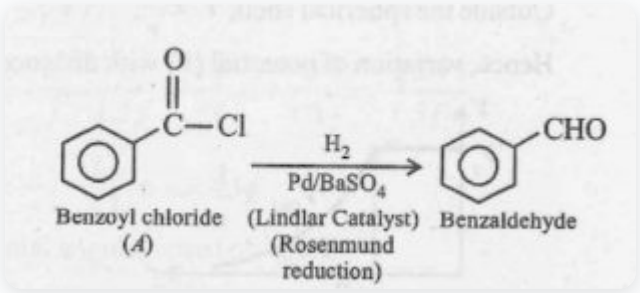
(B) Toluene

(C) Benzoic acid

(D) Acetophenone

Explanation:

Benzoyl chloride is right answer.



Question 40.

Identify the incorrect statement from the following:

[4 Marks]

(A) Lanthanoids reveal only +3 oxidation state

(B) The lanthanoid ions other than the $4f^0$ and the $4f^{14}$ type are all paramagnetic

(C) Zirconium and Hafnium have identical radii of 160 pm and 159 pm, respectively as a consequence of lanthanoid contraction

(D) The overall decrease in atomic and ionic radii from lanthanum to lutetium is called lanthanoid contraction

Explanation:

Most common oxidation state of lanthanoids is +3. However, +4 and +2 ions in solution are also known.

Question 41.

The half-life for a zero order reaction having 0.02 M initial concentration of reactant is 100 s. The rate constant (in mol L^{-1} s^{-1}) for the reaction is

[4 Marks]

(A) 1.0×10^{-4}

(B) 1.0×10^{-2}

(C) 2.0×10^{-4}

(D) 2.0×10^{-5}

Explanation:

For a zero order reaction, $t_{50} = (1/k) \times (a_0/2)$ (at t_{50} a= $a_0/2$)

$\Rightarrow k = a_0/2 \times t_{50} = 0.02M / 2\times 100s = 1 \times 10^{-4}$ mol L^{-1} s^{-1}

Question 42.

Match the coordination number and type of Hybridisation with distribution of hybrid orbitals in space based on valence bond theory.

[4 Marks]

	Coordination number and type of hybridisation		Distribution of hybrid orbitals in space
(A)	4, sp^3	(i)	trigonal bipyramidal
(B)	4, dsp^2	(ii)	octahedral
(C)	5, sp^3d	(iii)	tetrahedral
(D)	6, d^2sp^3	(iv)	square planar

Select the correct option :

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

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

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

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

Explanation:

(A)-(iii), (B)-(iv), (C)-(i), (D)-(ii) is the right answer.

	Coordination number	Hybridisation	Geometry
(A)	4	sp^3	Tetrahedral
(B)	4	dsp^2	Square planar
(C)	5	sp^3d	Trigonal bipyramidal
(D)	6	d^2sp^3	Octahedral

Question 43.

Match the element in column I with that in column II.

[4 Marks]

Column I	Column II
(A) Copper	(i) Non-metal
(B) Fluorine	(ii) Transition Metal
(C) Silicon	(iii) Lanthanoid
(D) Cerium	(iv) Metalloid

Identify the correct match :

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

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

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

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

Explanation:

(A)-(ii), (B)-(i), (C)-(iv), (D)-(iii) is right answer.

(A) $Cu(29) \Rightarrow [Ar]3d^{10}4s^1 \rightarrow$ *d*-block metal or transition metal.

(B) $F(9) \Rightarrow [He]2s^2 2p^5 \rightarrow$ *p*-block non-metal (gaseous).

(C) $Si(14) \Rightarrow [Ne]3s^2 3p^2 \rightarrow$ *p*-block metalloid (solid).

(D) $Ce(58) \Rightarrow [Xe]4f^1 5d^1 6s^2 \rightarrow$ *f*-block (4*f*) lanthanoid (metal).

Question 44.

In collision theory of chemical reaction, $Z_{(AB)}$ represents

[4 Marks]

(A) the collision frequency of reactants, A and B

(B) the fraction of molecules with energies equal to E_a

(C) the fraction of molecules with energies greater than E_a

(D) steric factor

Explanation:

Z_{AB} ⇒ collision frequency of reactants, A and B = number of effective binary collisions between A and B in one second in unit volume.

Question 45.

At standard conditions, if the change in enthalpy for the following reaction is −109 kJ mol^{-1}.

$H_2(g) + Br_2(g) \rightarrow 2HBr(g)$

Given that bond energy of H_2 and Br_2 is 435 kJ mol^{-1} and 192 kJ mol^{-1} respectively, what is the bond energy (in kJ mol^{-1}) of HBr?

[4 Marks]

(A) 735

(B) 518

(C) 368

(D) 259

Explanation:

$H_2(g) + Br_2(g) \rightarrow 2HBr(g)$

[H–H] + [Br–Br] → [H–Br]

⇒ $\Delta rH = \Sigma(BE)_{Reactants} - \Sigma(BE)_{Products}$(BE= bond energy)

⇒ $[(BE)_{H_2} + (BE)_{Br_2}] - [(BE)_{HBr} \times 2]$

⇒ $-109 = (435 + 192) - (BE)_{HBr} \times 2$

⇒ $(BE)HBr = 368$ kJ mol^{-1}

Question 46.

The solubility product for a salt of the type AB is 4×10^{-8}. What is the molarity of its standard solution?

[4 Marks]

(A) 2×10^{-4} mol/L

(B) 4×10^{-4} mol/L

(C) 2×10^{-6} mol/L

(D) 16×10^{-16} mol/L

Explanation:

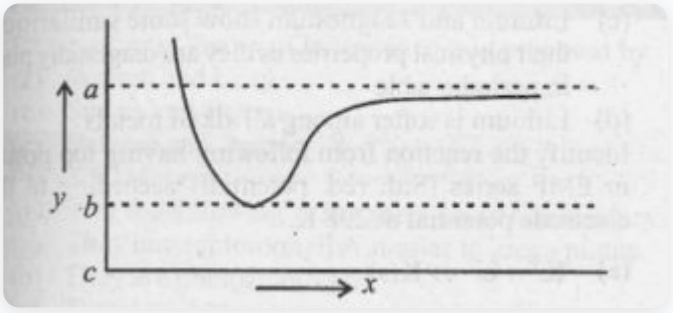
$AB \rightarrow A^+ + B^-$

$K_{sp} = s \times s = s^2 \Rightarrow s = \sqrt{K_{sp}} = \sqrt{(4 \times 10^{-8})} = 2 \times 10^{-4}$ mol L^{-1}

Question 47.

The potential energy (y) curve for H_2 formation as a function of internuclear distance (x) of the H atoms is shown below. The bond energy of H_2 is

[4 Marks]



(A) (b − a)

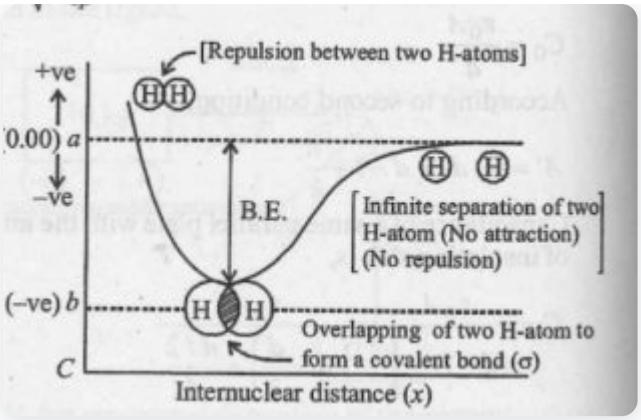
(B) (c − a)

(C) (b − a)/2

(D) (c − a)/2

Explanation:

From the above curve, bond energy (BE) of H_2 molecule is (b − a)



Question 48.

Match the element in Column I with methods of purification in Column II.

[4 Marks]

	Column I		Column II
(A)	Boron	(i)	Van Arkel method
(B)	Tin	(ii)	Mond's process
(C)	Zirconium	(iii)	Liquation
(D)	Nickel	(iv)	Zone refining

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

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

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

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

Explanation:

(A)-(iv), (B)-(iii), (C)-(i), (D)-(ii) is the right answer.

	Elements	Method of purification
(A)	Boron (B)	Zone-refining
(B)	Tin (Sn)	Liquation
(C)	Zirconium (Zr)	Van Arkel method
(D)	Nickel (Ni)	Mond's process

Question 49.

A liquid compound (x) can be purified by steam distillation only if it is

[4 Marks]

(A) Steam volatile, miscible with water

(B) Not steam volatile, miscible with water

(C) Not steam volatile, immiscible with water

(D) Steam volatile, immiscible with water

Explanation:

Steam distillation technique is applied to separate the substances which are steam volatile and immiscible with H_2O.

Question 50.

What is the role of gypsum, $CaS0_4.2H_2O$ in setting of cement? Identify the correct option from the following :

[4 Marks]

(A) to provide water molecules for hydration process

(B) to help to remove water molecules

(C) to fasten the setting process

(D) to slow down the setting process

Explanation:

Gypsum ($CaS0_4.2H_2O$) is present in Portland cement in an amount by mass of 2–3% . It slows down the process of setting cement , so that it gets sufficiently hardened.

Question 51.

'Which of te following substituted phenols is the strongest acid?

[4 Marks]

(A)



(B)



(C)



(D)



Explanation:

In given substituents, $-NO_2$, $-OCH_3$, $-CH_3$ and $-C_2H_5$, $-NO_2$ is a strong deactivating group due to −I and −R effect. So it will pull electrons towards itself and facilitates easy removal of H^+. Thus, p-nitrophenol will be strongest acid among the given compounds.

Question 52.

Deficiency of which vitamin causes osteomalacia?

[4 Marks]

(A) Vitamin E

(B) Vitamin A

(C) Vitamin K

(D) Vitamin D

Explanation:

Deficiency of Vitamin	Diseases
A	Xerophthalmia
D	Osteomalacia and Rickets
E	Fragility of RBCs
K	Increase in blood clotting time

Question 53.

Which one of the following reaction does not come under hydrolysis of phosphorus?

[4 Marks]

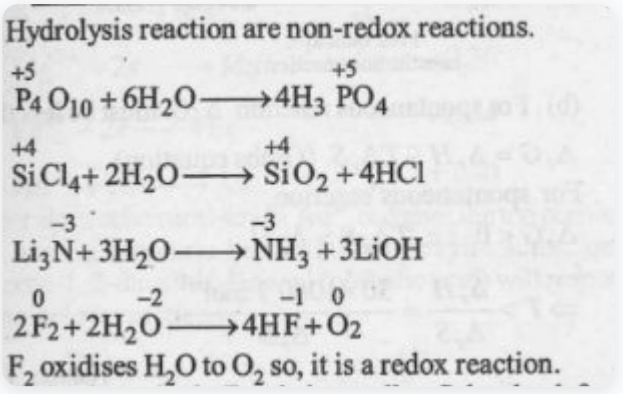
(A) $P_4O_{10}(s) + 6H_2O(l) \rightarrow 4H_3PO_4(aq)$

(B) $2F_2(g) + 2H_2O(l) \rightarrow 4HF(aq) + O_2(g)$

(C) $SiCl_4(l) + 2H_2O(l) \rightarrow SiO_2(s) + 4HCl(aq)$

(D) $Li_3N(s) + 3H_2O(l) \rightarrow NH_3(g) + 3LiOH(aq)$

Explanation:



Question 54.

Which one of the following compounds shows both, Frenkel as well as Schottky defects?

[4 Marks]

(A) ZnS

(B) AgI

(C) AgBr

(D) NaCl

Explanation:

AgBr shows both, Frenkel as well as Schottky defects.

Question 55.

Which of the following is not true about chloramphenicol?

[4 Marks]

(A) It inhibits the growth of only gram positive bacteria

(B) It is bacteriostatic

(C) It is not bactericidal

(D) It is a broad spectrum antibiotic

Explanation:

Antibiotics which kill or inhibit a wide range of gram-positive and gram-negative bacteria are said to be broad spectrum antibiotics whereas those effective mainly against gram-positive or gram-negative

bacteria are said to be narrow spectrum antibiotics.

Chloramphenicol is a bacteriostatic (inhibitory) broad spectrum antibiotic, which shows inhibitory effect on wide range of gram-positive and gram-negative bacteria (microbes).

Question 56.

The oxidation number of the underlined atom in the following species

Identify the incorrect option.

[4 Marks]

(A) $K_2Cr_2O_7$ is +6

(B) $HAuCl_4$ is +3

(C) Cu_2O is −1

(D) ClO_3^- is +5

Explanation:

Cu_2O is −1 is correct answer

$\overset{+3}{H\underline{Au}Cl_4} \Rightarrow 1\times(+1)+x+4\times(-1)=0 \Rightarrow x=+3.$

$Cu_2\overset{2-}{\underline{O}} \Rightarrow 2\times(+1)+x=0 \Rightarrow x=-2$

$\overset{+5}{\underline{Cl}O_3^-} \Rightarrow x+3\times(-2)=-1 \Rightarrow x=+5$

$K_2\overset{+6}{\underline{Cr_2}}O_7 \Rightarrow 2\times(+1)+2x+7\times(-2)=0 \Rightarrow x=+6$

Question 57.

Which of the following will NOT undergo S_n1 reaction with OH^- ?

[4 Marks]

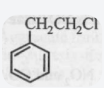
(A) $CH_2 = CH - CH_2Cl$

(B)



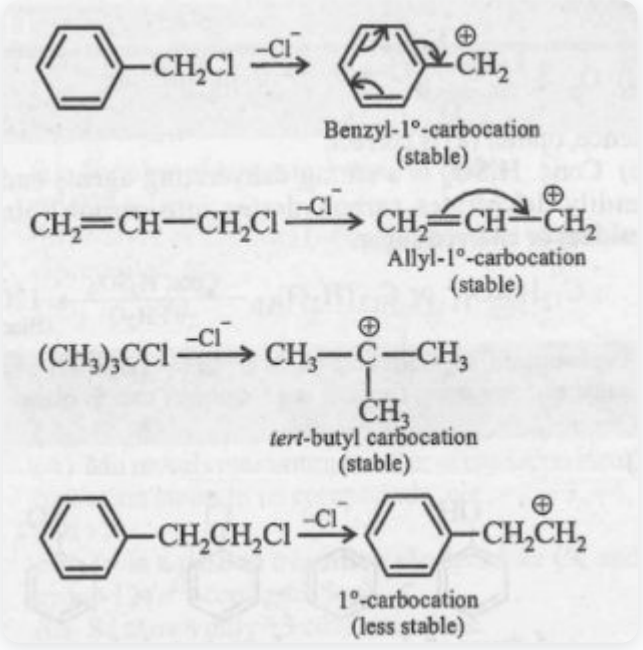
(C) $CH_2 = C(CH_3) - CH_2Cl$

(D)



Explanation:

The S1_N reactivity is proportional to stability of carbocation formed in the rate determining step.



Question 58.

Reaction of propanamide with ethanolic sodium hydroxide and bromine will give

[4 Marks]

(A) Methylamine

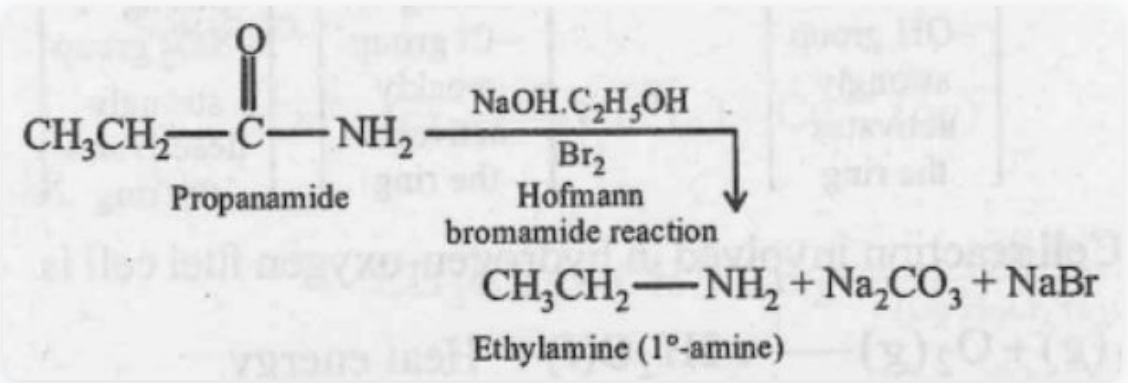
(B) Aniline

(C) Ethylamine

(D) Propylamine

Explanation:

Ethylamine is right answer.



Question 59.

In which of the sols, the colloidal particles are with negative charge?

[4 Marks]

(A) Haemoglobin

(B) TiO_2

(C) Starch

(D) Hydrated Al_2O_3

Explanation:

Starch is the right answer.

	Sols	Charged on Sols
(a)	Hydrated Al_2O_3	Positive
(b)	TiO_2	Positive
(c)	Haemoglobin	Positive
(d)	Starch	Negative

Question 60.

The minimum pressure required to compress 600 dm^3 of a gas at 1 bar to 150 dm^3 at 40°C is

[4 Marks]

(A) 2.5 bar

(B) 4.0 bar

(C) 1.0 bar

(D) 0.2 bar

Explanation:

As per Boyle's Law,

$P_1V_1 = P_2V_2$

Given,

P_1 = 1 bar, P_2 = ?

V_1 = 600 dm^3, V_2 = 150 dm^3

⇒ $P_2(min) = (P_1V_1)/V_2$

= (1 × 600)/150

= 4 bar

Question 61.

The number of angular nodes and radial nodes in 3s orbital are

[4 Marks]

(A) 3 and 0, respectively

(B) 0 and 2, respectively

(C) 0 and 1, respectively

(D) 1 and 0, respectively

Explanation:

For 3s-orbital,

n = 3, l = 0

Number of radial nodes

= (n − l − 1)

= 3 − 0 − 1

= 2

Number of angular nodes = l = 0

Question 62.

Which of the following statement is correct about Bakelite?

[4 Marks]

(A) It is a linear polymer

(B) It is a cross linked polymer

(C) It is an addition polymer

(D) It is a branched chain-polymer

Explanation:

Bakelite is a cross linked condensation thermosetting copolymer of phenol (C_6H_5OH) and formaldehyde (HCHO).

Question 63.

Among the compounds shown below which one revealed a linear structure?

[4 Marks]

(A) HOCl

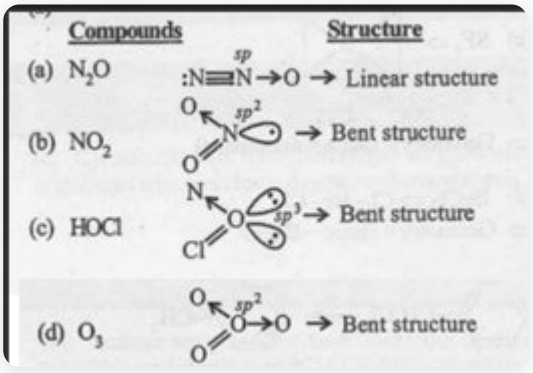
(B) N_2O

(C) NO_2

(D) O_3

Explanation:

N_2O is right answer.



Question 64.

The reaction of concentrated sulphuric acid with carbohydrate ($C_{12}H_{22}O_{11}$) is an example of

[4 Marks]

(A) Reduction

(B) Oxidation

(C) Sulphonation

(D) Dehydration

Explanation:

Conc. H_2SO_4 is a strong dehydrating agent and it readily dehydrates carbohydrates into carbon (black residue or charred sugar).

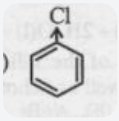
$$C_{12}H_{22}O_{11} \text{ or } C_{12}(H_2O)_{11} \xrightarrow[-11\,H_2O]{\text{Conc. } H_2SO_4} \underset{\text{(Black)}}{12C}$$

Question 65.

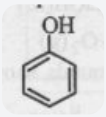
Which of the following compound is most reactive in electrophilic aromatic substitution?

[4 Marks]

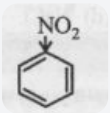
(A)



(B)



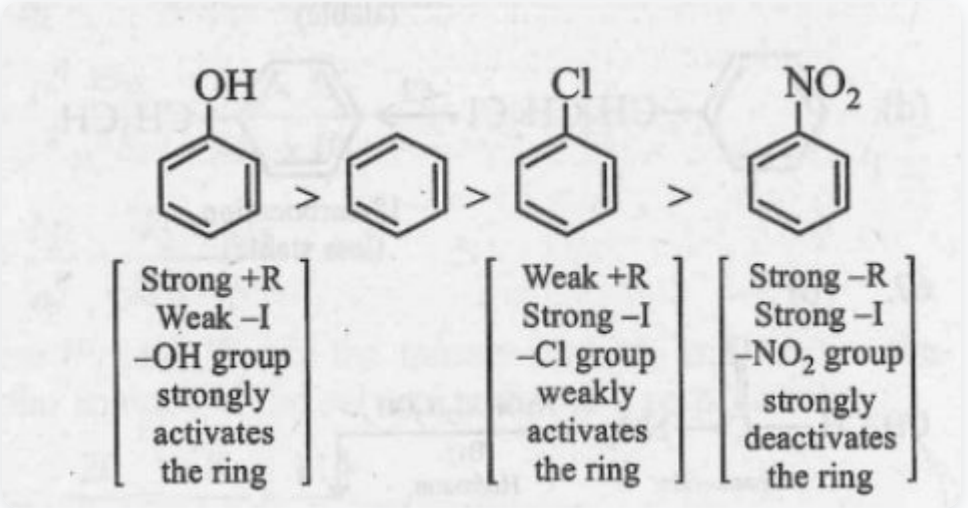
(C)



(D)



Explanation:



Question 66.

In a typical fuel cell, the reactant (R) and product (P) are

[4 Marks]

(A) R = $H_2(g)$, $N_2(g)$; P = $NH_3(aq)$

(B) R = $H_2(g)$, $O_2(g)$; P = $H_2O(l)$

(C) R = $H_2(g)$, $O_2(g)$; $Cl_2(g)$; P = $HClO_4(aq)$

(D) R = $H_2(g)$, $O_2(g)$; P = $H_2O(v)$

Explanation:

Cell reaction involved in hydrogen-oxygen fuel cell is

$2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$ + Heat energy

get converted into electrical energy.

Question 67.

Which of the following statement is NOT true about acid rain?

[4 Marks]

(A) It is due to reaction of SO_2, NO_2 and CO_2 with rain water

(B) Its pH is less than 5.6

(C) Causes no damage to monuments like Taj Mahal

(D) It is harmful for plants

Explanation:

Acid rain which is mainly caused by air pollutants like SO_2, NO_2 and CO_2, reacts with marble, $CaCO_3$ of Taj Mahal causing damage to it.

$CaCO_3(s) + H_2SO_4(aq) \rightarrow CaSO_4(aq) + H_2O(l) + CO_2(g)$

As a result, Taj Mahal is being slowly disfigured, discoloured and lustreless.

Question 68.

Match the compounds of Xe in column I with the molecular structure in column II

[4 Marks]

Column I	Column II
(A) XeF_2	(i) Square planar
(B) XeF_4	(ii) Linear
(C) XeO_3	(iii) Square pyramidal
(D) $XeOF_4$	(iv) Pyramidal

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

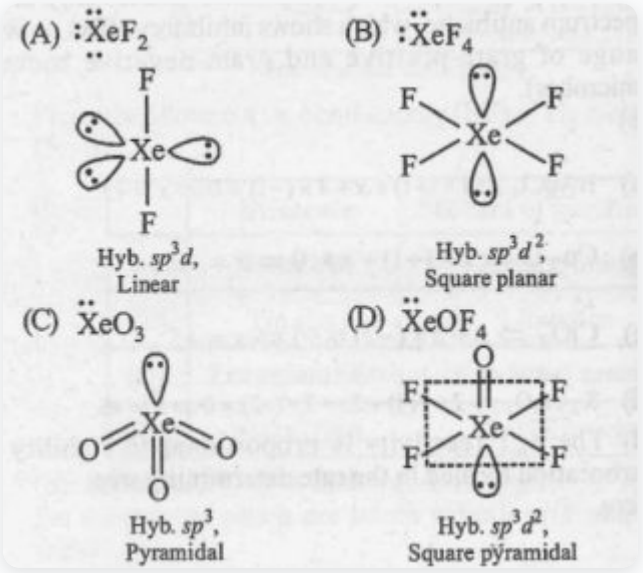
(B) (A)-(ii), (B)-(i), (C)-(iv), (D)-(iii)

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

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

Explanation:

(A)-(ii), (B)-(i), (C)-(iv), (D)-(iii) is right answer.



Question 69.

Which of the following is a free radical substitution reaction?

[4 Marks]

(A) Benzene with $Br_2/AlCl_3$

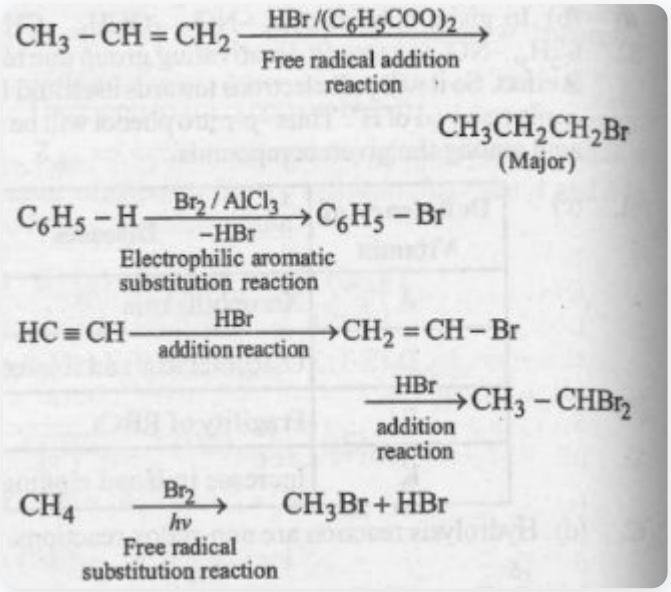
(B) Propene with $HBr/(C_6H_5COO)_2$

(C) Acetylene with HBr

(D) Methane with $Br_2/h\nu$

Explanation:

Methane with $Br_2/h\nu$ is correct answer.



Question 70.

If for a certain reaction $\Delta_{rr}H$ is 30 kJ mol^{-1} at 450 K, the value of $\Delta_r S$ (in JK^{-1} mol^{-1}) for which the same reaction will be spontaneous at the same temperature, is

[4 Marks]

(A) 33

(B) 70

(C) -33

(D) -70

Explanation:

For spontaneous reaction Δ_rG must be less than zero.

$\Delta_rG = \Delta_rH - T\Delta_rS$

For spontaneous reaction,

$\Delta_rG < 0$, i.e., $T\Delta_rS > \Delta_rH$

$\Rightarrow T > \Delta_rH / \Delta_rS = 30 \times 1000$ J mol^{-1}/Δ_rS [Given, T=450K]

$\Rightarrow \Delta_rS > (30 \times 1000$ J $mol^{-1}) / 450$ K

$\Rightarrow \Delta_rS > 66.67$ J mol^{-1} K^{-1}

$\therefore$ For reaction to be spontaneous, the value of Δ_rS must be greater than 66.67 J mol^{-1} K^{-1}.

Question 71.

Which of the following statement is not true about glucose?

[4 Marks]

(A) It is an aldopentose

(B) It is a reducing sugar

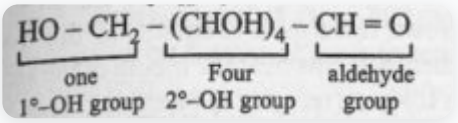
(C) It contains five hydroxyl groups

(D) It is an aldohexose

Explanation:

Glucose ($C_6H_{12}O_6$) can be simply shown as

Glucose is an aldohexose (made of six carbon atoms) and it is also a reducing sugar as it contains −CHO group alongwith 5 −OH groups are present.



Question 72.

Identify the correct statement from the following.

[4 Marks]

(A) Lithium chloride is deliquescent and crystallises as a hydrate, $LiCl \cdot H_2O$.

(B) Lithium and Magnesium show some similarities in their physical properties as they are diagonally placed in periodic table

(C) The order of hydration enthalpies of alkaline earth cations $Be^{2+} < Mg^{2+} < Ca^{2+} < Sr^{2+} < Ba^{2+}$

(D) Lithium is softer among all alkali metals

Explanation:

LiCl is deliquescent and crystallises as a dihydrate,

$LiCl \cdot 2H_2O$.

The hydration enthalpies of alkaline earth metal ions decreases with increase in ionic size down the group. So, order of hydration enthalpy is

$Be^{2+} > Mg^{2+} > Ca^{2+} > Sr^{2+} > Ba^{2+}$

Li and Mg show diagonal relationship in periodic table, hence their physical and chemical properties are almost similar.

Li is much harder than other alkali metals.

Question 73.

Identify the reaction from following having top position in EMF series (Std. red. potential at 298 K).

[4 Marks]

(A) $K^+ + e^- \rightarrow K(s)$

(B) $Fe^{2+} + 2e^- \rightarrow Fe(s)$

(C) $Au^{3+} + 3e^- \rightarrow Au(s)$

(D) $Mg^{2+} + 2e^- \rightarrow Mg(s)$

Explanation:

Reduction half reaction E/V at 298 K

$K^+ + e^- \rightarrow K$, −2.93

$Mg^{2+} + 2e \rightarrow Mg$, −2.36

$Fe^{2+} + 2e \rightarrow Fe$, −0.44

$Au^{3+} + 3e \rightarrow Au$, +1.40

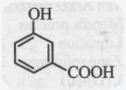
As per electrochemical series, Au^{3+} occupies the top position.

Question 74.

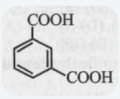
Which of the following acid will form an (a) Anhydride on heating and (b) Acid imide on strong heating with ammonia?

[4 Marks]

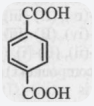
(A)



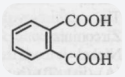
(B)



(C)

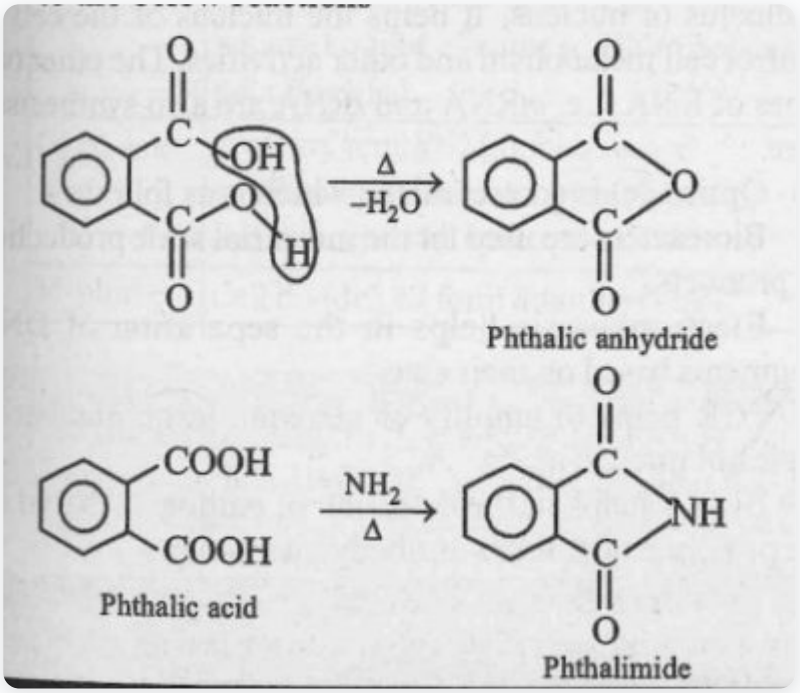


(D)



Explanation:

Among isomeric benzene dicarboxylic acids, only benzene-1,2-dicarboxylic acid (phthalic acid) will respond to the below reactions.



Question 75.

One mole carbon atom weighs 12 g, the number of atoms in it is equal to, (Mass of carbon-12 is 1.9926×10^{-23} g)

[4 Marks]

(A) 12×10^{23}

(B) 1.2×10^{23}

(C) 6.022×10^{23}

(D) 6.022×10^{22}

Explanation:

Number of atoms in 1 mole of carbon $=6.022 \times 10^{23}$

Question 76.

Which of the following oxide is amphoteric in nature?

[4 Marks]

(A) GeO_2

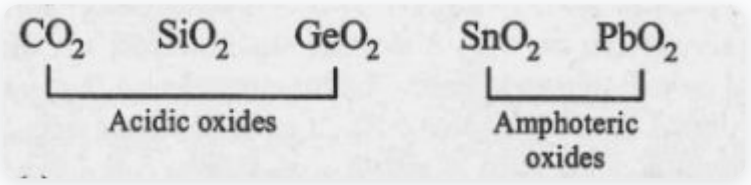
(B) SiO_2

(C) CO_2

(D) SnO_2

Explanation:

Nature of dioxides (MO_2) of group 14 elements can be represented as



Question 77.

Isotonic solutions have same

[4 Marks]

(A) Osmotic pressure

(B) Freezing temperature

(C) Boiling temperature

(D) Vapour pressure

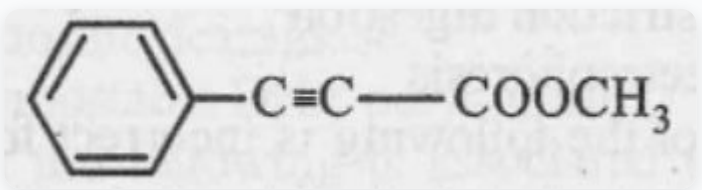
Explanation:

Isotonic solutions are such solution which have same osmotic pressure at a given temperature.

Question 78.

How many (i) sp^2 hybridised carbon atoms and (ii) π bonds are present in the following compound?

[4 Marks]



(A) 7,6

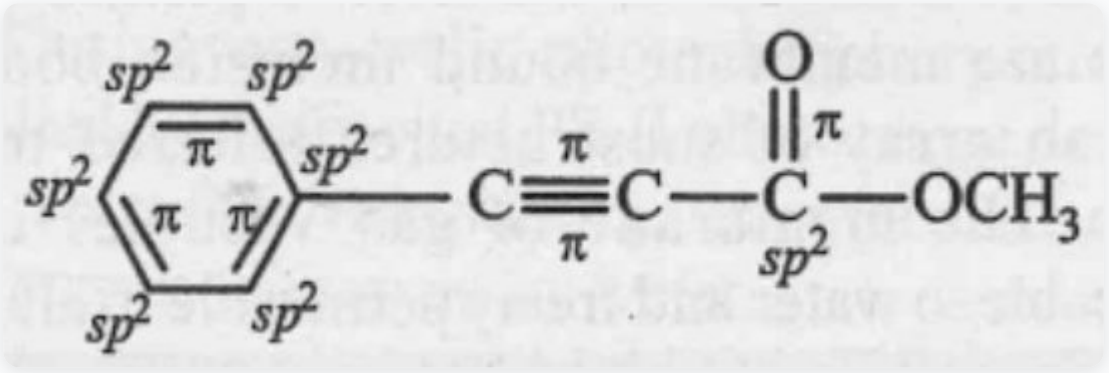
(B) 8,6

(C) 7,5

(D) 8,5

Explanation:

Number of sp^2 hybridised carbon atom = 7 Number of π-bonds = 6



Question 79.

Chromosomal theory of inheritance was proposed by

[4 Marks]

(A) T.H. Morgan

(B) Bateson and Punnet

(C) Sutton and Boveri

(D) Watson and Crick

Explanation:

Chromosomal theory of inheritance was proposed by Sutton and Boveri independently in1902. The two workers found a close similarity between the transmission of hereditary traits and behaviour of chromosomes while passing from one generation to the next through gametes.

Question 80.

Which of the following is incorrect about Cynobacteria?

[4 Marks]

(A) They are photoautotrophs

(B) They have chlorophyll A similar to green plants

(C) They lack heterocysts

(D) They often form blooms in polluted water bodies

Explanation:

Cyanobacteria or blue-green algae are photosynthetic organisms which perform oxygenic photosynthesis. They have the ability of nitrogen fixation due to the presence of large pale cells called heterocyst in their filaments. Due to the presence of thick walls, heterocysts are impermeable to oxygen.

Question 81.

The impact of immigration on population density is

[7 Marks]

(A) Neutralized by natality

(B) Both positive and negative

(C) Negative

(D) Positive

Explanation:

Population density is the number of individuals present per unit area or volume at a given time. It is calculated by the formula

D = N/S,

where D = Density, N = Total number of individuals and S = Number of units of space. Since immigration increases the number of individuals in an area, population density increases. Thus, immigration has positive impact on population density.

Question 82.

Which of the following statements is incorrect?

[4 Marks]

(A) RuBisCO is a bifunctional enzyme

(B) RuBisCO action requires ATP and NADPH

(C) In C_4 plants, the site of RuBisCO activity is mesophyll cell

(D) The substrate molecule for RuBisCO activity is a 5-carbon compound

Explanation:

C_4 plants, Kranz anatomy in leaf is found due to the presence of two types of cells viz., mesophyll cells and bundle sheath cells.

The mesophyll cells are specialised to perform light reaction, evolve O_2 and produce assimilatory power. The bundle sheath cells possess RuBisCO and thus, perform RuBisCO activity in this site.

Question 83.

Inclusion bodies of blue-green, purple and green photosynthetic bacteria are

[4 Marks]

(A) Microtubules

(B) Gas vacuoles

(C) Contractile vacuoles

(D) Centrioles

Explanation:

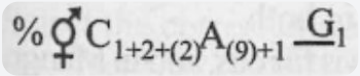
Gas vacuoles are the inclusion bodies in many aquatic prokaryotes like blue-green, purple and green photosynthetic bacteria. These are generally small, hollow cylindrical structure which facilitates air permeability. Gas vacuoles are membrane bound inclusion bodies that contain an array of substructures referred to as gas vesicles. The membrane of gas vacuoles is rigid, impermeable to water and freely permeable to all gases.

Question 84.

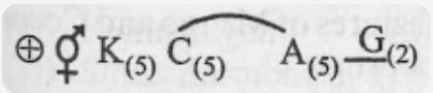
Which of the following is the correct floral formula of Liliaceae?

[4 Marks]

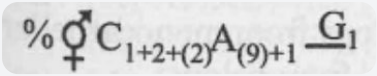
(A)



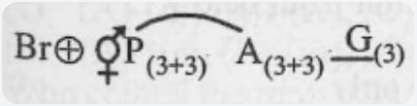
(B)



(C)



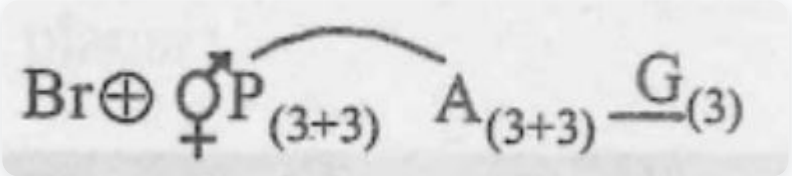
(D)



Explanation:

Floral formula of Liliaceae is

It represents bracteate, actinomorphic, bisexual flowers having six tepals and six epitepalous stamens. Ovary is superior with three lobed stigma.



Question 85.

Male and female gametophytes do not have an independent free living existence in :

[4 Marks]

(A) Angiosperms

(B) Algae

(C) Pteridophytes (c) Algae

(D) Bryophytes

Explanation:

Male and female gametophyte do not have an independent free-living existence in gymnosperms and angiosperms. In them they remain within the sporangia retained on the sporophytes. The pollen grain is released from the microsporangium and are carried in air current and come in contact with the opening of the ovules borne on megasporophylls. The pollen tube carrying the male gametes grows towards archegonia in the ovule and discharges their contents near the mouth of the archegonia.

Question 86.

Inhibitory substances in dormant seeds cannot be removed by subjecting seeds to :

[4 Marks]

(A) Nitrate

(B) Chilling conditions

(C) Gibberellic acid

(D) Ascorbic acid

Explanation:

Presence of inhibitory substances in dormant seeds can be removed by subjecting seeds to

(i) growth hormones like gibberellic acid, cytokinins

(ii) by stratification in which seeds requiring low temperature are first allowed to imbibe water and then exposed to low temperature.

(iii) low concentration of nitrates because it promote seed germination.

Ascorbic acid is known to cause seed dormancy as it is a potent chemical inhibitor.

Question 87.

In some plants thalamus contributes to fruit formation. Such fruits are termed as:

[4 Marks]

(A) True fruits

(B) Parthenocarpic fruit

(C) False fruits

(D) Aggregate fruits

Explanation:

A fruit in which floral parts other than ovary, like thalamus, base of sepals, petals, etc., fuse with pericarp and contribute in fruit formation is called false fruit or pseudocarp.

In strawberry, the whole soft edible part of fruit is represented by an overgrown receptacle. Apple, mulberry and strawberry are false fruits.

Question 88.

The biosynthesis of ribosomal RNA occurs in :

[4 Marks]

(A) Ribosomes

(B) Nucleolus

(C) Golgi apparatus

(D) Microbodies

Explanation:

The biosynthesis of ribosomal RNA occurs in nucleolus of nucleus. It helps the nucleus of the cell to control cell metabolism and other activities. The other two types of RNA, i.e., mRNA and tRNA are also synthesised here.

Question 89.

Large, empty colorless cells of the adaxial epidermis along the veins of grass leaves are

[4 Marks]

(A) Bulliform cells

(B) Bundle sheath cells

(C) Lenticels

(D) Guard cells

Explanation:

Grass leaves are isobilateral or typical monocot leaves. In such leaves, at places, the upper or adaxial epidermis contain groups of large thin-walled, colourless cells called bulliform cells. These cells are highly vacuolated and can store water, if available. However, these cells lose water and become flaccid in case of water deficiency.

Question 90.

Identify the wrong match pair :

[4 Marks]

	Molecule	Shape or geometry of molecule
(a)	NH_3	Trigonal pyramidal
(b)	PCl_5	Trigonal planar
(c)	SF_6	Octahedral
(d)	$BeCl_2$	Linear

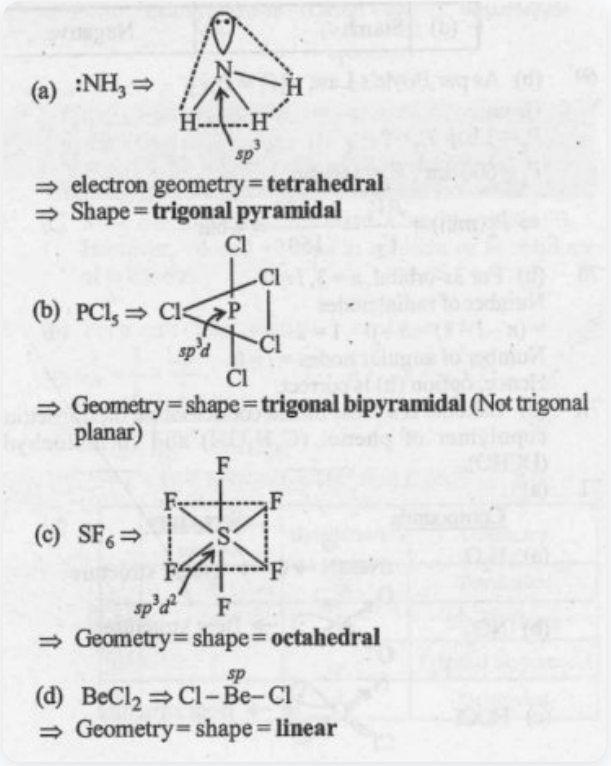
(A) b

(B) d

(C) a

(D) c

Explanation:



Question 91.

Match the following aspects with the respective metal

Aspects	Metal
(A) The metal which reveals a maximum number of oxidation states	(i) Scandium

(B) The metal although placed in the 3d block is considered not as a transition (ii) Copper element.

(C) The metal which does not exhibit variable oxidation states. (iii) Manganese

(D) The metal which in +1 oxidation state in aqueous solution (iv) Zinc undergoes disproportionation.

[4 Marks]

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

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

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

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

Explanation:

(A) Mn reveals the maximum number of oxidation states, i.e., six oxidation states in its compounds, viz., +2, +3, +4, +5, +6 and +7.

(B) Zn is a pseudo-transition element like Cd and Hg of Group 12 *(d^{10}-configuration)*.

(C) Sc shows only +3 oxidation state.

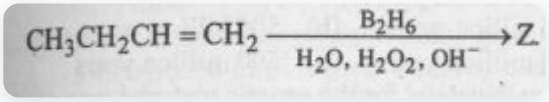
(D) Cu^+ undergoes disproportionation reaction in aqueous solution.

$2Cu^+(aq) \longrightarrow Cu^0(s) + Cu^{2+} \longrightarrow Cu0(s) + Cu^{2+}(aq)$

Question 92.

What is Z?

[4 Marks]



(A) $CH_3CH_2CH(OH)CH_3$

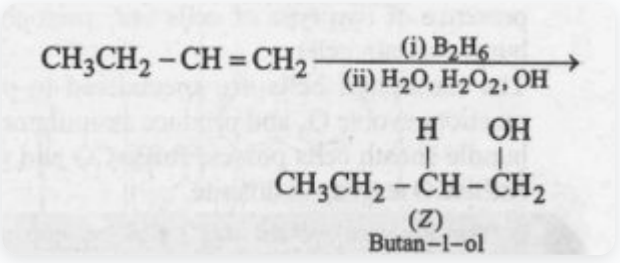
(B) $CH_3CH_2CH_2CHO$

(C) $CH_3CH_2CH_2CH_2OH$

(D) $CH_3CH_2CH_2CH_3$

Explanation:

It is an example of the hydroboration–oxidation reaction of an alkene, which undergoes hydration to give an alcohol.



Question 93.

The Mean Free Path l for a gas molecule depends upon the diameter, d, of the molecule as:

[4 Marks]

(A) $l \propto 1/d^2$

(B) $l \propto d$

(C) $l \propto 1/d^2$

(D) $l \propto d^2$

Explanation:

The mean free path / for a gas molecule is given as

$l = 1/\sqrt{2}\Pi n d^2 \Rightarrow l \propto 1/d^2$

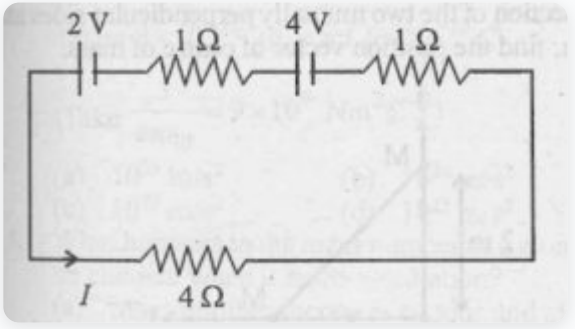
where, d = diameter of molecule of gas

n=number of molecules per unit volume.

Question 94.

For the circuit shown in the figure, the current I will be

[4 Marks]



(A) 0.5A

(B) 0.75 A

(C) 1.5A

(D) 1A

Explanation:

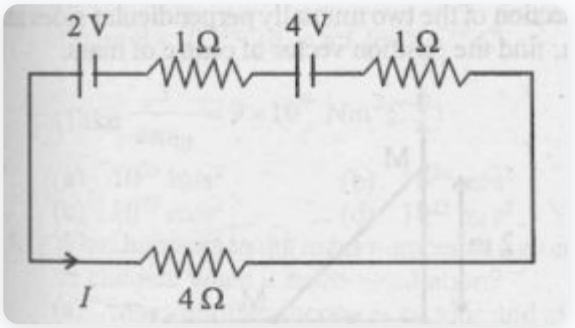
The circut diagram is shown below.

Applying Kirchoff's voltage law in the loop, we get

4I+I:1- 4+I.1-2=0

⇒ 6I = 6

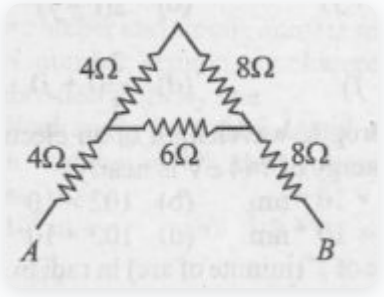
⇒ I=1A



Question 95.

The equivalent resistance between A and B for the mesh shown in the figure is

[4 Marks]



(A) 4.8Ω

(B) 16Ω

(C) 7.2Ω

(D) 30Ω

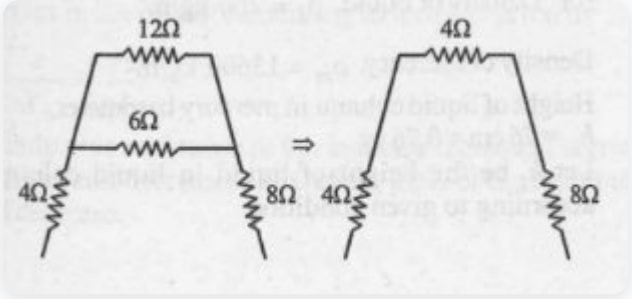
Explanation:

Resistance of 4Ω and 8Ω are connected in series with

each other and parallel with a resistance of 6Ω .

∴R_ AB= [(4+8)‖6]+4+8

=(12+6)/(12×6)+ 12= 16Ω



Question 96.

In a mixture, DNA fragments are separated by

[4 Marks]

(A) Restriction digestion

(B) Electrophoresis

(C) Bioprocess engineering

(D) Polymerase chain reaction

Explanation:

Electrophoresis is a technique used for the separation of substances of different ionic properties. It is used in molecular biology and biotechnology. RDT to separate the DNA fragments that are being cut by restriction endonuclease. In this technique, DNA fragments " are loaded on agarose gel and then electric field is applied. X Due to negatively charged, DNA fragments move towards anodes (+ve charge). The smaller fragments move farther way as compared to larger fragments and thus, these get separated.

Question 97.

Which of the following is incorrect for wind-pollinated plants?

[4 Marks]

(A) Pollen grains are light and non-sticky

(B) Well exposed stamens and stigma

(C) Many ovules in each ovary

(D) Flowers are small and not brightly coloured

Explanation:

Because wind pollinated plants have single ovule in each ovary. In case of wind pollination, anemophily, many pollens are produced because anemophily is highly wasteful and non-directional

process. These pollens are also light-weight, small, dusty and dry.

To catch the wind-borne pollens, stigma is exposed and hairy. Flowers are small and inconspicuous, colourless and nectarless.

Question 98.

In a mitotic cycle, the correct sequence of phases is

[4 Marks]

(A) G_1, G_2, S, M

(B) S, G_1, G_2, M

(C) G_1, S, G_2, M

(D) M, G_1, G_2, S

Explanation:

In a mitotic cycle, the correct sequence of phases is G_1, S, G_2, M. The first three phases, i.e., G_1, S, G_2 occurring during interphase. Whereas the M-phase is the period of actual cell division. The major event occurring in each phase is tabulated below:

Phases	Activities
G_1-phase	Cell becomes metabolically active, enzymes and proteins required for replication are synthesised.
S-phase	Synthesis or replication of DNA occurs so that amount of DNA per cell gets doubled.
G_2-phase	Proteins required for mitosis are synthesised while the growth of cell continues.
M-phase	Cell divides to form daughter cells.

Question 99.

Embryological support for evolution was proposed by

[4 Marks]

(A) Ernst Haeckel

(B) Alfred Wallace

(C) Karl Ernst von Baer

(D) Charles Darwin

Explanation:

Embryological support for evolution was proposed by Ernst Haeckel. He proposed biogenetic law in the year 1864. According to this law, 'structure of origin develops earlier than structure of newer origin. In other words, it states "Ontogeny repeats phylogeny", i.e., development of structures in an organism follow the same sequence as they evolved in his ancestors.

Question 100.

Phycorythrin is the major pigment in

[4 Marks]

(A) Green algae

(B) Blue green algae

(C) Brown algae

(D) Red algae

Explanation:

Phycoerythrin is the major pigment in red algae or rhodophytes. The photosynthetic pigments in red algae include chlorophyll-a, carotenoids and phycobilins. Phycoerythrin belongs to the phycobilins. These pigments are soluble in water.

Phycoerythrin (PE) is a red protein pigment complex produced by the light-harvesting phycobiliprotein family. It is present in red algae and cryptophytes as an accessory to the main chlorophyll pigments responsible for photosynthesis.

Question 101.

According to Alexander von Humboldt

[4 Marks]

(A) There is no relationship between species richness and area explored

(B) Species richness increases with increasing area, but only up to limits

(C) Species richness goes on increasing with increasing area of exploration

(D) Species richness decreases with increasing area of exploration

Explanation:

Alexander von Humboldt was a German naturalist and geographer. He proposed that within a region, species richness increases with increasing explored area, but only up to a limit.

Accordingly, the relation between species richness and area for a wide variety of taxa turn out to be rectangular hyperbola. The relationship appears as a straight line on a logarithmic scale and described by the equation:

log S = log C + Z log A

Where, **S = Species richness**, **A = Area**, **Z = Regression coefficient**, **C = Y-intercept**.

Question 102.

In the polynucleotide chain of DNA, a nitrogenous base is linked to the -OH of

[4 Marks]

(A) 1' C pentose sugar

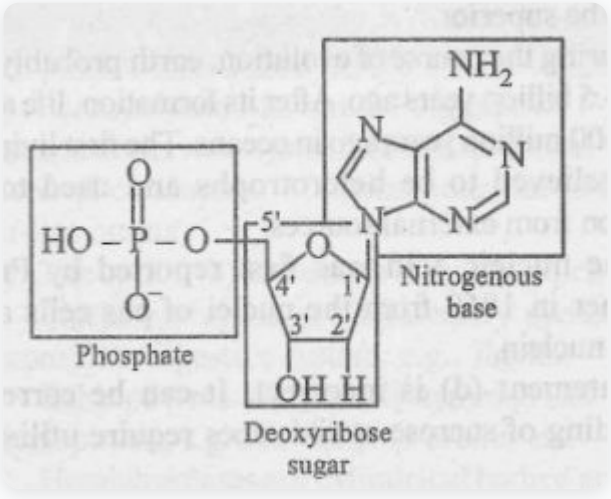
(B) 2' C pentose sugar

(C) 3' C pentose sugar

(D) 5' C pentose sugar

Explanation:

In a DNA polynucleotide chain, a nitrogenous base is linked to the hydroxyl (–OH) of 1' C pentose sugar. It is represented in the structure given below.



Question 103.

During non-cyclic photophosphorylation, when electrons are lost from the reaction centre at PSII, what is the source which replaces these electrons?

[4 Marks]

(A) Carbon dioxide

(B) Water

(C) Oxygen

(D) Light

Explanation:

During non-cyclic photophosphorylation, electrons expelled by the excited PS-II photocentre does not return to it. Therefore, it requires an external electron donor and that purpose is served by water.

H_2O undergo photolysis and the electrons thus released are picked up by PS-II (P_{680}) and handed over to PS-I or P_{700}.

Question 104.

In Recombinant DNA technology antibiotics are used

[4 Marks]

(A) to detect alien DNA

(B) to impart disease-resistance to the host plant

(C) as selectable markers

(D) to keep medium bacteria-free

Explanation:

Normally, the genes encoding resistance to antibiotics such as chloramphenicol, ampicillin, tetracycline or kanamycin, etc., are considered useful selectable markers for *E. coli*.

Vectors carry an antibiotic-resistant gene which helps to select the recombinant cells from non-recombinant ones as only recombinant cells would exhibit the antibiotic resistance and would be able to survive in antibiotic rich medium. Such genes that the host cell requires for growth under certain conditions and differentiate the recombinant cells from non-recombinant ones are called as selectable ‘markers.

Question 105.

Which of the following statements is incorrect?

[4 Marks]

(A) Number of individuals decreases from first trophic level to fourth trophic level

(B) Energy content gradually decreases from first to fourth trophic level

(C) Biomass decreases from first to fourth trophic level

(D) Energy content gradually increases from first to fourth trophic level

Explanation:

It can be corrected as the energy content decreases from the first (producer) to fourth (consumer) level. At each level about 90% of energy is lost and only 10% is passed to the next level.

Question 106.

Attachment of spindle fibers to kinetochores of chromosomes begins in

[4 Marks]

(A) Metaphase

(B) Anaphase

(C) Telophase

(D) Prophase

Explanation:

During the metaphase stage of cell cycle, spindle fibres originating from the centrosomes attaches to the kinetochore of chromosomes. Kinetochore is a disc-shaped structure at the surface of centromere through which the sister chromatids are held together. During metaphase, the chromosomes arrange themselves at the equator or metaphase plate. Due to this arrangement, the attachment of spindle fibres to kinetochore is clearly visible.

Question 107.

Correct position of floral parts over thalamus in mustard plant is

[4 Marks]

(A) Gynoecium occupies the highest position, while the other parts are situated below it.

(B) Gynoecium is situated in the centre, and other parts of the flower are located at the rim of the thalamus, at the same level.

(C) Margin of the thalamus grows upward, enclosing the ovary completely, and other parts arise below the ovary.

(D) Gynoecium is present in the centre and other flowers cover it partially.

Explanation:

A flower has four different whorls arranged successively on the swollen end of the stalk or pedicel called thalamus or receptacle. In mustard, flower is hypogynous, i.e., the gynoecium occupies the highest position while the other parts are situated below it. The ovary in such flowers is said to be superior.

Question 108.

After about how many years of formation of earth, life appeared on this planet?

[4 Marks]

(A) 50 million years

(B) 50 billion years

(C) 500 million years

(D) 500 billion years

Explanation:

During the course of evolution, earth probably formed about 4.5 billion years ago. After its formation, life appeared about 500 million years ago in oceans. The first living forms were believed to be heterotrophs and used to derive nutrition from external resources.

Question 109.

The term 'Nuclein' for the genetic material was used by

[4 Marks]

(A) Franklin

(B) Chargaff

(C) Miescher

(D) Mendel

Explanation:

The nucleic acid was first reported by Friedrich Miescher in 1869 from the nuclei of pus cells and was named nuclein.

Question 110.

Select the incorrect statement.

[4 Marks]

(A) Elements most easily mobilized in plants from one region to another are : phosphorus, sulphur, nitrogen and potassium

(B) Transport of molecules in phloem can be bidirectional

(C) Unloading of sucrose at sink does not involve the utilization of ATP

(D) Movement of minerals in xylem is unidirectional

Explanation:

Long distance transport of sucrose from the source to sink is carried out by phloem. It is bidirectional movement. Both loading of food at the source and unloading of the same at sink region are active processes, i.e., require energy in the form of ATP.

Question 111.

The number of contrasting characters studied by Mendel for his experiments was

[4 Marks]

(A) 2

(B) 4

(C) 14

(D) 7

Explanation:

Mendel conducted breeding experiments on garden pea by selecting seven pairs of contrasting characters. Luckily all these characters were related as dominant and recessive and none of them showed linkage. The seven pairs of contrasting characters in pea plant were

Characters of pea plant

Character	Contrasting Trait	
	Dominant	Recessive
Stem height	Tall	Dwarf
Flower colour	Violet	White
Flower position	Axial	Terminal
Pod shape	Full	Constricted
Pod colour	Green	Yellow
Seed shape	Round	Wrinkled
Seed colour	Yellow	Green

Question 112.

Vegetative propagule in Agave is termed as

[4 Marks]

(A) Rhizome

(B) Eye

(C) Bulbil

(D) Offset

Explanation:

Vegetative propagule in *Agave* is bulbil. It develops as a small bud on the axial leaf and after falling on the soil, it develops into a new plant.

Question 113.

Identify the statement which is incorrect.

[4 Marks]

(A) Tyrosine possesses aromatic ring in its structure

(B) Sulphur is an integral part of cysteine

(C) Glycine is an example of lipids

(D) Lecithin contains phosphorus atom in its structure

Explanation:

Glycine is a example of amino acid. It is a neutral amino acid that contains only one amino group and one carboxylic group with non-cyclic hydrocarbon chain.

Question 114.

A species which was introduced for ornamentation but has become a trouble-some weed in India :

[4 Marks]

(A) Parthenium hysterophorus

(B) Eichhornia crassipes

(C) Trapa spinosa

(D) Pmpsalis juliflora

Explanation:

Eichhornia crassipes (water hyacinth) was introduced in several tropical countries including India for ornamental purpose but later this exotic species became a trouble-some aquatic weed.

This free floating weed clogged rivers and lakes and threatened the survival of many native species to the point of extinction. This species was called "Terror of Bengal" in India.

Eichhornia crassipes (water hyacinth) is an exotic shrub which is growing at an alarming rate on the surface of water body. It inhibits the growth of fish as well as other aquatic organisms because of lack of light and also decreases biochemical oxygen demand in the water.

Question 115.

Pyruvate dehydrogenase activity during aerobic respiration requires :

[4 Marks]

(A) Iron

(B) Cobalt

(C) Calcium

(D) Magnesium

Explanation:

Pyruvate dehydrogenase enzyme is involved in the conversion of pyruvate to acetyl CoA, after the completion of glycolysis and before the start of Krebs' cycle. This enzyme is made up of

decarboxylase, lipoic acid, transacetylase and Mg^{2+} ion. The reaction occur in following way -

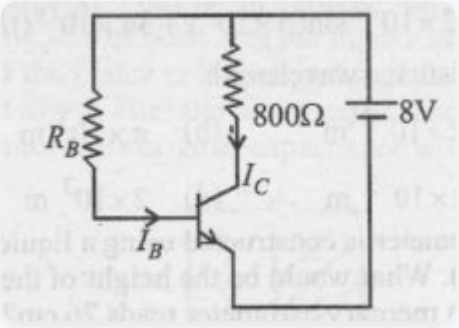
$Pyruvate + NAD^+ + CoA \rightarrow Acetyl\ CoA + NADH + H^+ + CO_2$

In this reaction Mg^{2+} acts as a cofactor.

Question 116.

A n-p-n transistor is connected in common emitter configuration (see figure) in which collector voltage drop across load resistance (800 Ω) connected to the collector circuit is 0.8 V. The collector current is

[4 Marks]



(A) 2mA

(B) 0.2mA

(C) 0.1mA

(D) 1mA

Explanation:

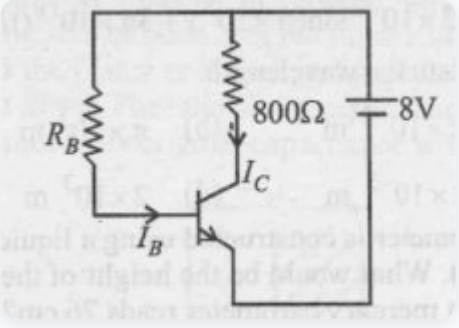
Given,

Resistance of load, R_c=800Ω

Voltage drop across load resistance, V_c= 0.8V

Current through R_c

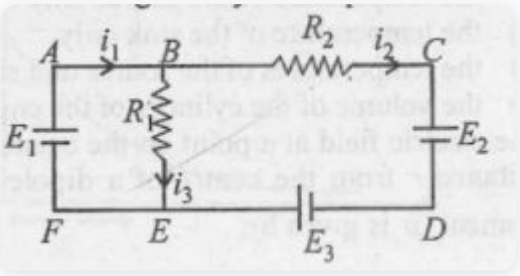
$I_c = 0.8/R_c = 0.8/800 = 10^{-3}A = 1\ mA$



Question 117.

For the circuit given below, the Kirchoff's loop rule for the loop BCDERB is given by the equation

[4 Marks]



(A) $-i_2R_2+E_2+E_3+i_3R_1 =0$

(B) $-i_2R_2+E_2-E_3+i_3R_1 =0$

(C) $i_2 R_2+E_2-E_3- i_3 R_1 =0$

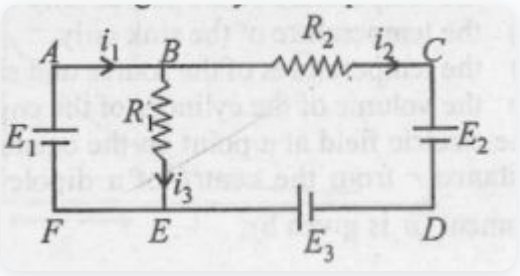
(D) $i_2R_2+E_2+E_3+i_3R_1 =0$

Explanation:

The circuit diagram is given below

Applying Kirchoff's Voltage law in loop BCDEB,

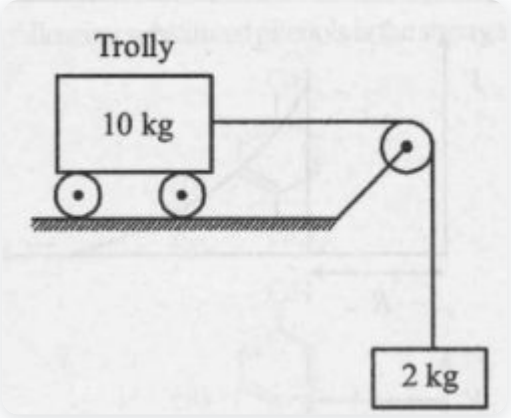
$R_2I_2+E_2—E_3- I_3R_1 =0.$



Question 118.

Calculate the acceleration of the block and trolly system shown in the figure. The coefficient of kinetic friction between the trolly and the surface is 0.05. (g = 10 m/s²?, 'mass of the string is negligible and no other friction exists).

[4 Marks]



(A) 1.25m/s²

(B) 1.00 m/s²

(C) 1.50m/s²

(D) 1.66m/s²

Explanation:

ss of the trolly, m_1, = 10 kg

Coefficient of kinetic friction, μ =0.05

Mass of the block, m_2, =2 kg

The free-body diagram of the block and trolly system is.

shown in the figure.

If'a' be the common acceleration of the system.

Equation of motion of 10 kg trolly,

T- μ R=10a

⇒T-0.05x10g =10a

⇒T-0.05x10x10 =10a

⇒ T- 5=10a .....(i)

Equation of motion of 2kg block,

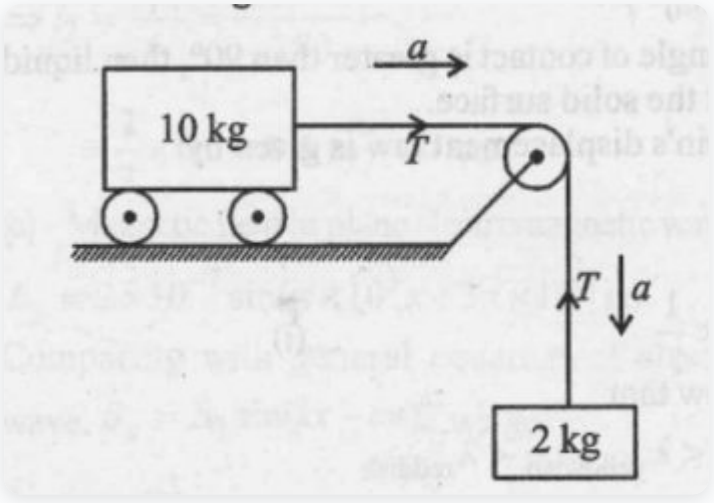
2g-T=2a⇒ 2x10-T=2a

⇒20-T=2a (ii)

'Adding Eqs. (i) and (ii), we have

20-5⇒12a⇒ 15=12a

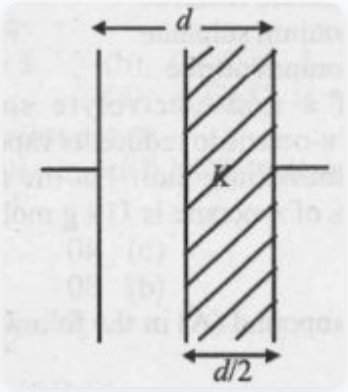
⇒ a=15/12 =5/4=1.25 m s^{-2}



Question 119.

A parallel plate capacitor having cross-sectional area A and separation d has air in between the plates. Now an insulating slab of same area but thickness d/2 is inserted between the plates as shown in figure having dielectric constant K(=4). The ratio of new capacitance to its original capacitance to its original capacitance will be

[4 Marks]



(A) 4:1

(B) 8:5

(C) 2:1

(D) 6:5

Explanation:

Capacitance of parallel plate capacitor with air is

$C_o=\varepsilon_o A/d$

According to the second condition,

$A'=A$, $d'=d-t+t/k$

The capacitance of the same parallel plate capacitor with the introduction of an insulating slab is

$C=\varepsilon_o A/(d-t)+t/k=\varepsilon_o A/(d/2+d/8)=8/5\ .\varepsilon_o A/d$

The required ratio is

$C/C_o=8/5\ \cdot\varepsilon_o A/d/\varepsilon_o A/d$

$C/C_o=8/5$

$\Rightarrow C:C_o=8:5$

Question 120.

In the following, in each set a conservation approach and an example of method of conservation are given

(A) In situ conservation – Biosphere Reserve

(B) Ex situ conservation – Sacred groves

(C) In situ conservation – Seed bank

(D) Ex situ conservation – Cryopreservation

Select the option with correct match of approach and method

[1 Marks]

(A) (B) and (D)

(B) (A) and (C)

(C) (A) and (D)

(D) (A) and (B)

Explanation:

In situ conservation is on site conservation technique, i.e. the species are protected in their natural habitats only. In this approach, the important components of biological diversity are protected and managed through protected areas, biosphere reserves and sacred forests or lakes.

On the other hand, ex situ conservation involves the conservation of selected rare flora or fauna in places outside their natural habitat. It includes off site collection and gene banks. In gene banks, germplasm, tissue or embryos are stored in preserved conditions using the technologies like orchards, tissue culture and cryopreservation.

Question 121.

Match the following techniques or instruments with their usage:

Techniques / Instruments	Usage
(A) Bioreactor	**(i)** Separation of DNA fragments
(B) Electrophoresis	**(ii)** Production of large quantities of products
(C) PCR **(D)** ELISA	**(iii)** Detection of pathogen, based on antigen-antibody reaction **(iv)** Amplification of

[4 Marks]

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

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

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

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

Explanation:

* Bioreactors are used for the industrial scale production

of products.

* Electrophoresis helps in the separation of DNA

fragments based on their size.

* PCR helps to amplify or generate large number of copies of nucleic acids.

* ELISA helps in the detection of pathogens based on

the principle of antigen-antibody interaction.

Question 122.

Identify the correct features of Mango and Coconut fruits.

(i) In both, fruit is a drupe.
(ii) Endocarp is edible in both.
(iii) Mesocarp in Coconut is fibrous, and in Mango it is fleshy.
(iv) In both, fruit develops from a monocarpellary ovary only.

Select the correct option from below:

[4 Marks]

(A) (i) and (iv) only

(B) (i), (ii) and (iii) only

(C) (i), (iii) and (iv) only

(D) (i) and (ii) only

Explanation:

Both mango and coconut are drupe, belonging to the class of simple succulent fruits. These are also called stone fruits as the endocarp is stony and non-edible. These fruits develop from a monocarpellary ovary. In coconut, epicarp is membranous and mesocarp is fibrous. In mango, mesocarp is fleshy and pulpy.

Thus, statements (i), (iii), (iv) are correct while (ii) is incorrect.

Question 123.

Match the items in Column I with those in Column II:

Column I	Column II
(A) Herbivores–Plants	(i) Commensalism
(B) Mycorrhiza–Plants	(ii) Mutualism
(C) Sheep–Cattle	(iii) Predation
(D) Orchid–Tree	(iv) Competition

Select the correct option from the following:

[4 Marks]

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

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

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

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

Explanation:

Option ((A)–(iii), (B)–(ii), (C)–(iv), (D)–(i)) is the correct match, which is as follows:

- The relationship between herbivores and plants is prey-predator type in which herbivores are predators and plants are the prey.
- In mycorrhiza, the plant association benefits both species and thus represents mutualism.
- Sheep and cattle show competition for common resources like food, i.e., grass.
- Orchids are epiphytes that grow on trees and derive nutrients from them. In this process, trees are neither harmed nor helped. Thus, it is a type of commensalism relationship.

Question 124.

Air (Prevention and Control of Pollution) Act was amended in 1987 to include among pollutants:

[4 Marks]

(A) Particulates of size 2.5 micrometer or below

(B) Vehicular exhaust

(C) Allergy causing pollen

(D) Noise

Explanation:

The Air (Prevention and Control of Pollution) Act was amended in 1987 to include noise among pollutants. This Act is meant for preserving the quality of air and controlling air and noise pollution and prevent their detrimental effects on human health and health of other biological entities.

Question 125.

In *Glycine max*, the product of biological nitrogen fixation is transported from the root nodules to other parts as:

[4 Marks]

(A) Ureides

(B) Ammonia

(C) Glutamate

(D) Nitrates

Explanation:

In Glycine max (Soyabean), the products of biological nitrogen fixation are transported from the root nodules to other parts as nitrate.

Question 126.

Which of the following statements about cork cambium is incorrect?

[4 Marks]

(A) It is couple of layers thick.

(B) It forms secondary cortex on its outer side.

(C) It forms a part of periderm.

(D) It is responsible for the formation of lenticels.

Explanation:

Cork cambium is a meristematic tissue involved in secondary growth. It is also called phellogen. It is a few layers thick and cuts off cells into an outer layer and an inner layer. The former differentiates into cork or phellem, while the latter differentiates into secondary cortex or phelloderm. The phellogen, phellem, and phelloderm are collectively known as periderm. In woody trees, phellogen cuts off closely arranged parenchymatous cells, which rupture the epidermis and form lenticels. Thus, statement (b) is incorrect while the others are correct.

Question 127.

Match the following:

Column I	Column II
(A) Aquaporin	(i) Amide

(B) Asparagine	(ii) Polysaccharide
(C) Abscisic acid	(iii) Polypeptide
(D) Chitin	(iv) Carotenoids

Select the correct option:

[4 Marks]

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

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

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

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

Explanation:

Option ((A)–(iii), (B)–(i), (C)–(iv), (D)–(ii)) is the correct match, which is as follows:

- Chemically, aquaporins are major intrinsic proteins that form pores in the membranes of cells.
- Asparagine is the beta-amide derivative of aspartic acid.
- Abscisic acid is an apocarotenoid.
- Chitin is a heteropolysaccharide consisting of two types of monosaccharide monomers.

Question 128.

Which of the following statements is incorrect about gymnosperms?

[4 Marks]

(A) Their seeds are not covered.

(B) They are heterosporous.

(C) Male and female gametophytes are free living.

(D) Most of them have narrow leaves with thick cuticle.

Explanation:

Statement (Male and female gametophytes are free living.) is incorrect. It can be corrected as follows:

In gymnosperms, the male and the female gametophytes do not have an independent free-living existence. The male gametophyte remains within the sporangia, retained on the sporophytes, and is dependent on the sporophyte.

Question 129.

Which of the following elements helps in maintaining the structure of ribosomes?

[4 Marks]

(A) Molybdenum

(B) Magnesium

(C) Zinc

(D) Copper

Explanation:

Each ribosome consists of two unequal subunits, a larger and a smaller one. Mg^{2+} ions are required for binding the two subunits. Below 0.0001 M Mg^{2+}, the two subunits dissociate, while above this strength, the two subunits form the dimer.

Question 130.

Match the following concerning the activity/function and the phytohormone involved:

Column I	Column II
(A) Fruit ripener	(i) Abscisic acid
(B) Herbicide	(ii) GA_3
(C) Bolting agent	(iii) 2, 4-D
(D) Stress hormone	(iv) Ethephon

Select the correct option from the following:

[4 Marks]

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

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

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

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

Explanation:

Option ((A)–(iv), (B)–(iii), (C)–(ii), (D)–(i)) is the correct match, which is as follows:

- The functions of different phytohormones include:
    - Ethephon is a common derivative of ethylene and is used to ripen fruits.
    - 2,4-D is a synthetic auxin and is used as a herbicide against dicotyledonous weeds.
    - Gibberellic acid induces bolting in plants, i.e., the promotion of internodal elongation just prior to their reproductive phase.
    - Abscisic acid is a stress hormone as it helps plants overcome unfavourable conditions by inhibiting growth.

Question 131.

Who coined the term 'Kinetin'?

[4 Marks]

(A) Darwin

(B) Went

(C) Kurosawa

(D) Skoog and Miller

Explanation:

The term kinetin was coined by Skoog and Miller in 1955. Chemically, kinetin is 6-furfuryl aminopurine. It was the first cytokinin to be discovered from degraded autoclaved herring sperm DNA. Kinetin does not occur naturally.

Question 132.

Which of the following statements is incorrect regarding the phosphorus cycle?

[4 Marks]

(A) It is sedimentary cycle

(B) Phosphates are the major form of phosphorus reservoir

(C) Phosphorus solubilising bacteria facilitate the release of phosphorus from organic remains

(D) There is appreicable respiratory release of phosphorus into atmosphere

Explanation:

Statement (There is appreicable respiratory release of phosphorus into atmosphere) is incorrect and can be corrected as follows:

Phosphorus cycle is a type of sedimentary cycle, i.e., its main reservoirs are soil and rocks. It is mainly found as phosphates in rocks. During this cycle, phosphorus-solubilising bacteria like Pseudomonas, Acetobacter, etc. help release phosphorus from organic remains. A large amount of phosphate is lost in the sea by sedimentation. There is no respiratory release of phosphorus into the atmosphere because phosphorus is an inorganic nutrient that does not take part in respiration.

Question 133.

First discovered restriction endonuclease that always cuts DNA molecule at a particular point by recognising a specific sequence of six base pairs is

[4 Marks]

(A) Thermostable DNA polymerase

(B) Adenosine deaminase

(C) EcoR I

(D) Hind II

Explanation:

Hind II was the first discovered endonuclease. It was isolated by Smith, Wilcox, and Kelley (1968) from *Haemophilus influenzae* bacteria. It always cuts DNA at a particular point by recognising a specific sequence of six base pairs. The recognition sequence of Hind II is:

5′-GTCGAC-3′
3′-CAGCTG-5′

Question 134.

Which of the following is associated with decrease in cardiac output?

[4 Marks]

(A) Parasympathetic neural signals

(B) Pneumotaxic centre

(C) Sympathetic nerves

(D) Adrenal medullary hormones

Explanation:

Parasympathetic neural signals (a component of the autonomic nervous system) decrease the rate of heartbeat, speed of conduction of action potential and thereby the cardiac output.

Question 135.

Match the following group of organisms with their respective distinctive characteristics and select the correct option.

Organisms	Characteristics
(A) Platyhelminthes	(i) Cylindrical body with no segmentation
(B) Echinoderms	(ii) Warm-blooded animals with direct development
(C) Hemichordates	(iii) Bilateral symmetry with incomplete digestive system
(D) Aves	(iv) Radial symmetry with indirect development

[4 Marks]

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

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

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

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

Explanation:

The option ((A)–(iii), (B)–(iv), (C)–(i), (D)–(ii) is the correct match, which is as follows:

- Platyhelminthes are bilaterally symmetrical with an incomplete digestive system, e.g., *Taenia*.
- Echinoderms are radially symmetrical with indirect development, e.g., starfish, sea urchin, etc.
- Hemichordates are cylindrical-bodied animals with no segmentation, e.g., *Balanoglossus*.
- Aves are warm-blooded animals with direct development, e.g., pigeon.

Question 136.

Which is the basis of genetic mapping of human genome as well as DNA fingerprinting?

[4 Marks]

(A) Polymorphism in hnRNA sequence

(B) Single nucleotide polymorphism

(C) Polymorphism in DNA sequence

(D) Polymorphism in RNA sequence

Explanation:

Polymorphism in DNA sequence is the basis of genetic mapping of the human genome as well as DNA fingerprinting. Polymorphism simply means variation at the genetic level that arises due to mutation.

Question 137.

The best example for pleiotropy is:

[4 Marks]

(A) Phenylketonuria

(B) Colour Blindness

(C) Skin colour

(D) ABO Blood group

Explanation:

The best example of pleiotropy is phenylketonuria, which occurs in humans. In pleiotropy, a single gene can exhibit multiple phenotypic expressions. This gene is called a pleiotropic gene. In phenylketonuria, a single gene mutation that codes for the enzyme phenylalanine hydroxylase is seen. This manifests itself through phenotypic expressions characterised by mental retardation and a reduction in hair and skin pigmentation.

Question 138.

The total Lung Capacity (TLC) is the total volume of air accommodated in the lungs at the end of a force inspiration. This includes:

[4 Marks]

(A) RV; ERV; VC (Vital Capacity) and FRC (Functional Residual Capacity)

(B) RV; ERV; IC and EC

(C) RV; IC (Inspiratory Capacity); EC (Expiratory Capacity); and ERV

(D) RV (Residual Volume); ERV (Expiratory Reserve Volume); TV (Tidal Volume); and IRV (Inspiratory Reserve Volume)

Explanation:

The Total Lung Capacity (TLC) is the total volume of air accommodated in the lungs at the end of a forced inspiration. This includes Residual Volume (RV), Expiratory Reserve Volume (ERV), Tidal Volume (TV), and Inspiratory Reserve Volume (IRV).

TLC is also equal to Vital Capacity (VC) + Residual Volume (RV).

Thus, option (RV (Residual Volume); ERV (Expiratory Reserve Volume); TV (Tidal Volume); and IRV (Inspiratory Reserve Volume)) is correct.

Question 139.

Hormones stored and released from neurohypophysis are

[4 Marks]

(A) Prolactin and Vasopressin

(B) Thyroid stimulating hormone and Oxytocin

(C) Oxytocin and Vasopressin

(D) Oxytocin and Vasopressin

Explanation:

Neurohypophysis (pars nervosa) is also known as the posterior pituitary, which stores and releases two hormones called oxytocin and vasopressin. These hormones are actually synthesised by the hypothalamus and are transported axonally to the neurohypophysis.

Question 140.

According to Central Pollution Control Board (CPCB) what size (in diameter) of particulate is responsible for causing greater harm to human health?

[4 Marks]

(A) 3.0 micrometers

(B) 3.5 micrometers

(C) 4.0 micrometers

(D) 2.5 micrometers

Explanation:

According to the Central Pollution Control Board (CPCB), particulate matter of size 2.5 micrometres or less in diameter (PM2.5) is responsible for causing the greatest harm to human health. These fine particles can be inhaled deep into the lungs and can cause breathing and respiratory symptoms, irritation, inflammation, damage to the lungs, and premature deaths.

Question 141.

Cyclosporin A, used as immunosuppression agent, is produced from

[4 Marks]

(A) Trichoderma polysporum

(B) Saccharomyces cerevisiae

(C) Penicillium notatum

(D) Monascus purpureus

Explanation:

Bioactive molecule cyclosporin-A is used as an immunosuppressive agent in organ transplant patients. It is produced by the fungus *Trichoderma polysporum*.

- *Monascus purpureus* is a yeast that helps produce statins (blood cholesterol-lowering agents).
- *Saccharomyces cerevisiae* is a yeast that produces ethanol.
- *Penicillium notatum* is a fungus that produces penicillin (an antibiotic).

Question 142.

For the commercial and industrial production of Critic Acid, which of the following microbes is used?

[4 Marks]

(A) Saccharomyces cerevislae

(B) Clostridium butylicum

(C) Lactobacillus sp

(D) Aspergillus niger

Explanation:

For the commercial and industrial production of citric acid, the fungus *Aspergillus niger* is used. Other microbes help as follows:

Lactobacillus sp. – produces lactic acid

Saccharomyces cerevisiae – produces ethanol

Clostridium butylicum – produces butyric acid

Question 143.

All vertebrates are chordates but all chordates are not vertebrates, why?

[4 Marks]

(A) All chordates possess notochord throughout their life

(B) Notochord is replaced by vertebral column in adult of some chordates

(C) Ventral hollow nerve cord remains throughout life in some chordates

(D) All chordates possess vertebral column

Explanation:

The members of subphylum Vertebrata possess a notochord during the embryonic period. The notochord is replaced by a cartilaginous or bony vertebral column in the adult. Thus, all vertebrates are chordates, but all chordates are not vertebrates.

Question 144.

The phenomenon of evolution of different species in a given geographical area starting from a point and spreading to other habitats is called

[4 Marks]

(A) Natural selection

(B) Co-evolution

(C) Saltation

(D) Adaptive radiation

Explanation:

The process of evolution of different species in a given geographical area, starting from a point and literally radiating to other geographical areas (habitats), is called adaptive radiation.

Question 145.

E. coli has only 4.6×10^6 base pairs and completes the process of replication within 18 minutes; then the average rate of polymerisation is approximately:

[4 Marks]

(A) 1000 base pairs/second

(B) 3000 base pairs/second

(C) 4000 base pairs/second

(D) 2000 base pairs/second

Explanation:

E. coli has 4.6×10^6 base pairs. It completes the replication process in 18 minutes, i.e., 18×60 seconds.

Rate of polymerisation = 4.6×10^6 bp/18×60 s

= $4.6 \times 10^5 / 18 \times 6 = 46 \times 10^4 / 108 = 460000/108 = 42591$ bp/s

Rate of polymerisation = 42591 bp/s.

or approximately 4000 bp/sec.

Question 146.

The size of Pleuropneumonia-like organism (PPLO) is:

[4 Marks]

(A) 0.1 µm

(B) 0.02 µm

(C) 10–20 µm

(D) 1–2 µm

Explanation:

The size of various organisms/cells are:

- Pleuropneumonia-Like Organism (PPLO) – 0.1 µm
- Viruses – 0.02–0.2 µm
- Bacterial cell – 1–2 µm
- Eukaryotic cell – 10–20 µm

Question 147.

Intrinsic factor that helps in the absorption of vitamin B_{12} is secreted by:

[4 Marks]

(A) Chief cells

(B) Goblet cells

(C) Hepatic cells

(D) Oxyntic cells

Explanation:

Parietal cells (oxyntic cells) secrete HCl and intrinsic factor. The intrinsic factor is essential for the absorption of vitamin B_{12}. Goblet cells secrete mucus. Peptic (chief) cells secrete the proenzyme pepsinogen. Hepatic cells secrete bile.

Question 148.

Match the following columns with reference to cockroach and select the correct option:

Column I	Column II
(A) Grinding of the food	(i) Hepatic caecal particles

(B) Secrete gastric juice	(ii) 10th segment
(C) 10 pairs	(iii) Proventriculus
(D) Anal Cerci	(iv) Spiracles
	(v) Alary muscles

[4 Marks]

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

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

(C) (A)–(iv), (B)–(iii), (C)–(v), (D)–(ii)

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

Explanation:

The option ((A)–(iii), (B)–(i), (C)–(iv), (D)–(ii)) is the correct match with reference to the cockroach, which is as follows:

- Grinding of food particles is done by the proventriculus (gizzard).
- Hepatic caeca are a ring of 6–8 blind tubules present at the junction of the foregut and midgut. They secrete digestive juice.
- There are 10 pairs of small holes called spiracles present on the lateral side of the body, which are part of the respiratory system.
- Anal cerci are a pair of jointed filamentous structures present on both sides in the 10th segment.

Question 149.

The increase in osmolarity from outer to inner medullary interstitium is maintained due to:

(i) Close proximity between Henle's loop and vasa recta
(ii) Counter current mechanism
(iii) Selective secretion of HCO_3^- and hydrogen ions in PCT
(iv) Higher blood pressure in glomerular capillaries

[4 Marks]

(A) (iii) and (iv)

(B) (i), (ii) and (iii)

(C) Only (ii)

(D) (i) and (ii)

Explanation:

As the close proximity between the Henle's loop and vasa recta, along with the counter-current mechanism, helps maintain an increasing osmolarity towards the inner medullary interstitium, i.e., from 300 mOsmol L^{-1} in the cortex (outside) to about 1200 mOsmol L^{-1} in the inner medulla (inside).

Question 150.

Select the correct statement:

[4 Marks]

(A) Atrial Natriuretic Factor increases the blood pressure.

(B) Reduction in Glomerular Filtration Rate activates JG cells to release renin.

(C) Angiotensin II is a powerful vasodilator.

(D) Angiotensin II is a powerful vasodilator.

Explanation:

Statement in option (Reduction in Glomerular Filtration Rate activates JG cells to release renin.) is correct, as a reduction in the glomerular filtration rate (GFR) activates the juxtaglomerular (JG) cells to release renin, which converts angiotensinogen in blood into angiotensin-I.

Other statements are incorrect and can be corrected as follows:

- Atrial Natriuretic Factor (ANF) causes vasodilation and thereby decreases blood pressure.
- Angiotensin-II is a powerful vasoconstrictor and decreases the GFR.
- Counter-current pattern of blood flow is observed in the vasa recta.

Question 151.

Which of the following STDs are not curable?

[4 Marks]

(A) Chlamydiasis, Syphilis, Genital warts

(B) HIV, Gonorrhoea, Trichomoniasis

(C) Genital herpes, Hepatitis B, HIV infection

(D) Gonorrhoea, Trichomoniasis, Hepatitis B

Explanation:

Except for Hepatitis-B, genital herpes, and HIV infection, other sexually transmitted diseases are completely curable if detected early and treated properly. Diseases or infections that are transmitted through sexual intercourse are collectively called Sexually Transmitted Diseases (STDs), Venereal Diseases (VD), or Reproductive Tract Infections (RTIs).

Question 152.

Match the following columns and select the correct option:

Column I	Column II
(A) Smooth endoplasmic reticulum	(i) Protein synthesis
(B) Rough endoplasmic reticulum	(ii) Lipid synthesis
(C) Golgi complex	(iii) Glycosylation
(D) Centriole	(iv) Spindle formation

[4 Marks]

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

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

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

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

Explanation:

The option ((A)–(ii), (B)–(i), (C)–(iii), (D)–(iv)) is the correct match, which is as follows:

- Smooth Endoplasmic Reticulum (SER) is the major site for the synthesis of lipids.

- Rough Endoplasmic Reticulum (RER) is actively involved in protein synthesis and secretion.
- Golgi complex is an important site for the formation of glycoproteins and glycolipids, i.e., glycosylation.
- Centrioles help in spindle formation during cell division.

Question 153.

Hominid fossil discovered in Java in 1891, now extinct, having cranial capacity of about 900 cc was:

[4 Marks]

(A) Homo sapiens

(B) Homo erectus

(C) Australopithecus

(D) Neanderthal man

Explanation:

A hominid fossil discovered in Java in 1891, now extinct, having a cranial capacity of about 900 cc, was Homo erectus. It probably ate meat.

Question 154.

The proteolytic enzyme rennin is found in:

[4 Marks]

(A) Pancreatic juice

(B) Intestinal juice

(C) Gastric juice

(D) Bile juice

Explanation:

The proteolytic enzyme rennin is found in the gastric juice of infants. It helps in the digestion of milk proteins (casein) into paracasein.

Question 155.

Match the following columns and select the correct option:

Column I	Column II
(A) Dragonflies	(i) Biocontrol agents of several plant pathogens
(B) *Bacillus thuringiensis*	(ii) Get rid of Aphids and mosquitoes
(C) *Glomus*	(iii) Narrow spectrum insecticidal applications
(D) Baculoviruses	(iv) Biocontrol agent of lepidopteran plant pests
	(v) Absorb phosphorus from soil

[4 Marks]

(A) (A)–(iii), (B)–(v), (C)–(iv), (D)–(i)

(B) (A)–(ii), (B)–(iv), (C)–(v), (D)–(iii)

(C) (A)–(ii), (B)–(iii), (C)–(iv), (D)–(v)

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

Explanation:

Option ((A)–(ii), (B)–(iv), (C)–(v), (D)–(iii)) is the correct match, which is as follows:

- Dragonflies help to get rid of aphids and mosquitoes.
- Bacillus thuringiensis acts as a biocontrol agent for lepidopteran and plant pests.
- Glomus is a fungus that forms mycorrhiza to absorb phosphorus from the soil.
- Baculoviruses are used in narrow-spectrum insecticidal applications.

Question 156.

Select the incorrectly matched pair from the following:

[4 Marks]

(A) Neurons — Nerve cells

(B) Fibroblast — Areolar tissue

(C) Chondrocytes — Smooth muscle cells

(D) Osteocytes — Bone cells

Explanation:

The incorrectly matched pair is option (Chondrocytes — Smooth muscle cells). It can be corrected as follows:

Chondrocytes are cartilage cells. The intercellular material of cartilage is solid, pliable, and resistant to compression. Cells of this tissue are called chondrocytes, which are enclosed in small cavities within the matrix secreted by them.

Question 157.

The yellowish fluid "colostrum" secreted by mammary glands of mother during the initial days of lactation has abundant antibodies (IgA) to protect the infant. This type of immunity is called as:

[4 Marks]

(A) Autoimmunity

(B) Passive immunity

(C) Active immunity

(D) Acquired immunity

Explanation:

Passive immunity is when ready-made antibodies are directly given to protect the body against foreign agents.

For example, the yellowish fluid colostrum secreted by the mother during the initial days of lactation contains abundant antibodies (IgA) that protect the infant. The foetus also receives some antibodies from its mother through the placenta during pregnancy.

Question 158.

Select the correct option of haploid cells from the following groups:

[4 Marks]

(A) Spermatogonia, Primary spermatocyte, Spermatid

(B) Primary oocyte, Secondary oocyte, Spermatid

(C) Secondary spermatocyte, First polar body, Ovum

(D) Primary spermatocyte, Secondary spermatocyte, Second polar body

Explanation:

Out of the given options, the haploid cells are secondary spermatocyte, first polar body, ovum, secondary oocyte, spermatids and second polar body. The diploid cells are primary oocyte and primary spermatocyte. Thus, option (Secondary spermatocyte, First polar body, Ovum) is correct.

Question 159.

During Meiosis I, in which stage synapsis takes place?

[4 Marks]

(A) Leptotene

(B) Pachytene

(C) Diplotene

(D) Zygotene

Explanation:

During the zygotene stage of meiosis-I, chromosomes start pairing together and this process of association is called synapsis. Such paired chromosomes are called homologous chromosomes.

Question 160.

Select the correct statement from the following:

[4 Marks]

(A) The polymerase enzyme joins the gene of interest and the vector DNA.

(B) Restriction enzyme digestions are performed by incubating purified DNA molecules with restriction enzymes under optimum conditions.

(C) PCR is used for isolation and separation of gene of interest.

(D) Gel electrophoresis is used for amplification of a DNA segment.

Explanation:

Statement in option (Restriction enzyme digestions are performed by incubating purified DNA molecules with restriction enzymes under optimum conditions.) is correct, as restriction enzyme

digestion is performed by incubating purified DNA molecules with restriction enzymes under optimum conditions.

Other statements are incorrect and can be corrected as follows:

- Gel electrophoresis is used for the separation and isolation of DNA fragments.
- The DNA polymerase enzyme uses DNA templates to catalyse the polymerisation of deoxynucleotides.
- PCR (Polymerase Chain Reaction) is used for the amplification of a DNA segment.

Question 161.

Spooling is:

[4 Marks]

(A) Cutting of separated DNA bands from the agarose gel

(B) Collection of isolated DNA

(C) Transfer of separated DNA fragments to synthetic membranes

(D) Amplification of DNA

Explanation:

Spooling is the method of collection of isolated DNA in the form of fine threads in the suspension. This is done to isolate DNA from the cell during the process of recombinant DNA technology.

Question 162.

Match the following columns and select the correct option:

Column I	Column II
(A) Ovary	(i) Human chorionic Gonadotropin
(B) Placenta	(ii) Estrogen & Progesterone
(C) Corpus luteum	(iii) Androgens

(D) Leydig cells	(iv) Progesterone only

[4 Marks]

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

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

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

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

Explanation:

The option ((A)–(ii), (B)–(i), (C)–(iv), (D)–(iii)) is the correct match, which is as follows:

- Ovary produces oestrogen and progesterone.
- Placenta produces Human Chorionic Gonadotropin (hCG).
- Corpus luteum produces progesterone only.
- Leydig cells produce androgens.

Question 163.

Match the following columns and select the correct option:

Column I	Column II
(A) Pituitary hormone	(i) Steroid
(B) Epinephrine	(ii) Neuropeptides
(C) Endorphins	(iii) Peptides, proteins
(D) Cortisol	(iv) Biogenic amines

[4 Marks]

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

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

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

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

Explanation:

Option ((A)–(iii), (B)–(iv), (C)–(ii), (D)–(i)) is the correct match, which is as follows:

- Pituitary hormones are chemically peptides and proteins.
- Epinephrine is a biogenic amine.
- Endorphins are neuropeptides.
- Cortisol is a steroid hormone.

Question 164.

The laws and rules to prevent unauthorised exploitation of bio-resources are termed as:

[4 Marks]

(A) Biopiracy

(B) Bioethics

(C) Biopatenting

(D) Bioengineering

Explanation:

Bioethics are sets of laws and rules to prevent unauthorised exploitation of bioresources.

Biopiracy is the use of bioresources by multinational companies and other organisations without proper authorisation from the countries and people concerned, and without compensatory payment.

Biopatenting is the grant of patents on biological products, organisms, processes, or bioresources.

Bioengineering is the application of the life sciences, physical sciences, mathematics, and engineering principles to define and solve problems in biology, medicine, healthcare, and other fields.

Question 165.

Match the following columns and select the correct option:

Column I	Column II
(i) Typhoid	(A) *Haemophilus influenzae*
(ii) Malaria	(B) *Wuchereria bancrofti*
(iii) Pneumonia	(C) *Plasmodium vivax*
(iv) Filariasis	(D) *Salmonella typhi*

[4 Marks]

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

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

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

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

Explanation:

Option ((i)–(D), (ii)–(C), (iii)–(A), (iv)–(B)) is the correct match, which is as follows:

- Typhoid is caused by *Salmonella typhi*.
- Malaria is caused by *Plasmodium vivax*.
- Pneumonia is caused by *Haemophilus influenzae*.
- Filariasis is caused by *Wuchereria bancrofti*.

Question 166.

RNA interference is used for which of the following purposes in the field of biotechnology?

[4 Marks]

(A) to develop a pest resistant plant against infestation by nematode

(B) to enhance the mineral usage by the plant

(C) RNA interference is used for which of the following purposes in the field of biotechnology?

(D) to develop a plant tolerant to abiotic stresses

Explanation:

RNA interference (RNAi) is used to develop pest-resistant plants against infestation by nematodes. RNA interference takes place in all eukaryotic organisms as a method of cellular defence. This method involves silencing of a specific mRNA due to a complementary dsRNA (double-stranded RNA) molecule that binds to and prevents translation of the mRNA (silencing).

Question 167.

The rate of decomposition is faster in the ecosystem due to following factors EXCEPT:

[4 Marks]

(A) Presence of aerobic soil microbes

(B) Warm and moist environment

(C) Detritus rich in sugars

(D) Detritus richer in lignin and chitin

Explanation:

The rate of decomposition is faster in the ecosystem if detritus is rich in nitrogen and water soluble substances like sugars. Warm and moist environment also favour decomposition like wise high temperature and presence of aerobic soil microbes also helps in decomposition. But if detritus is rich in lignin and chitin decomposition rate gets slower. Thus, option (Detritus richer in lignin and chitin) is correct.

Question 168.

Which of the following conditions cause *erythroblastosis foetalis*?

[4 Marks]

(A) Mother Rh^{-}ve and foetus Rh^{+}ve

(B) Mother Rh^{+}ve and foetus Rh^{-}ve

(C) Both mother and foetus Rh^{-}ve

(D) Both mother and foetus Rh^{+}ve

Explanation:

If the mother is Rh−ve and the foetus is Rh+ve, then there can occur a condition called erythroblastosis foetalis. It is a special case of Rh incompatibility in which, during the second pregnancy of an Rh−ve mother carrying an Rh+ve foetus, the Rh antibodies formed by the mother (Rh−ve) can leak into the blood of the foetus (Rh+ve) and destroy the foetal RBCs.

Question 169.

In Human beings, at the end of 12 weeks (first trimester) of pregnancy, the following is observed:

[4 Marks]

(A) The head is covered with fine hair

(B) Most of the major organ systems are formed

(C) Eyelids and eyelashes are formed

(D) Movement of the foetus

Explanation:

In human beings, at the end of 12 weeks (first trimester), most of the major organ systems are formed (e.g., the limbs and external genital organs get well-developed).

Question 170.

Progestogens alone or in combination with estrogens can be used as a contraceptive in the form of

[4 Marks]

(A) Pills, injections and implants

(B) Injections only

(C) Implants only

(D) Pills only

Explanation:

Progesterone, alone or in combination with oestrogens, can be used as a contraceptive in the form of pills, injections, and implants under the skin.

They inhibit ovulation and implantation of the zygote, as well as alter the quality of cervical mucus to prevent or retard the entry of sperms.

Question 171.

'Which of the following options does correctly represent the characteristic features of phylum Annelida?

[4 Marks]

(A) Triploblastic, segmented body and bilaterally symmetrical

(B) Triploblastic, flattened body and acoelomate condition

(C) Triploblastic, unsegmented body and bilaterally symmetrica

(D) Diploblastic, mostly marine and radially symmetrical

Explanation:

Animals belonging to the phylum Annelida are triploblastic, bilaterally symmetrical, and metamerically segmented.

They exhibit organ system level of body organisation with the presence of a coelom. They may be aquatic (marine and freshwater) or terrestrial, free-living, and sometimes parasitic.

Question 172.

Inbreeding depression is

[4 Marks]

(A) Reduced fertility and productivity due to continued close inbreeding

(B) Reduced motility and immunity due to close inbreeding

(C) Decreased productivity due to mating of superior male and inferior female

(D) Decrease in body mass of progeny due to continued close inbreeding

Explanation:

Inbreeding depression is caused by continued inbreeding, especially close breeding, which reduces fertility and even productivity in animals. This problem is usually overcome by outbreeding.

Question 173.

Match the following columns and select the correct option:

Column I	Column II

(A) Rods and Cones	(i) Absence of photoreceptor cells
(B) Blind Spot	(ii) Cones are densely packed
(C) Fovea	(iii) Photoreceptor cells
(D) Iris	(iv) Visible coloured portion of the eye

[4 Marks]

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

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

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

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

Explanation:

The option ((A)–(iii), (B)–(i), (C)–(ii), (D)–(iv)) is the correct match, which is as follows:

- Rods and cones are the photoreceptor cells of the eye.
- Blind spot is the area where there is an absence of photoreceptor cells in the eye.
- Fovea is the area in the retina where cones are densely packed.
- Iris is the visible coloured portion of the eye.

Question 174.

Match the following columns and select the correct option:

Column I	Column II
(A) Pneumotaxic Centre	(i) Alveoli
(B) O_2 Dissociation Curve	(ii) Pons region of the brain

(C) Carbonic Anhydrase	(iii) Haemoglobin
(D) Primary site of exchange of gases	(iv) R.B.C.

[4 Marks]

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

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

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

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

Explanation:

Option ((A)–(ii), (B)–(iii), (C)–(iv), (D)–(i)) is the correct match, which is as follows:

- Pneumotaxic centre is present in the pons region of the brain.
- The O_2 dissociation curve is useful for studying the effect of factors like PCO_2, H^+ concentration, etc., on the binding of O_2 with haemoglobin.
- Carbonic anhydrase is an enzyme present on the surface of RBCs.
- The primary site of exchange of gases is the alveoli of the lungs.

Question 175.

Match the following columns and select the correct option:

Column I	Column II
(A) Gout	(i) Decreased levels of estrogen
(B) Osteoporosis	(ii) Low Ca^{2+} ions in the blood
(C) Tetany	(iii) Accumulation of uric acid crystals
(D) Muscular dystrophy	(iv) Autoimmune dystrophy disorder

	(v) Genetic disorder

[4 Marks]

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

(B) (A)–(iii), (B)–(i), (C)–(ii), (D)–(v)

(C) (A)–(iv), (B)–(v), (C)–(i), (D)–(ii)

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

Explanation:

The option ((A)–(iii), (B)–(i), (C)–(ii), (D)–(v)) is the correct match, which is as follows:

- Gout is inflammation of joints due to the accumulation of uric acid crystals.
- Osteoporosis occurs due to decreased levels of oestrogen in females. It is an age-related disorder characterised by decreased bone mass and increased chances of fractures.
- Tetany is rapid spasms (wild contractions) in muscles when there is a low concentration of Ca^{2+} ions in the blood.
- Muscular dystrophy is the progressive degeneration of skeletal muscles, mostly due to a genetic disorder.

Question 176.

Match the following columns and select the correct option:

Column I	Column II
(A) *Aptenodytes*	(i) Flying fox
(B) *Pteropus*	(ii) Angel fish
(C) *Pterophyllum*	(iii) Lamprey
(D) *Petromyzon*	(iv) Penguin

[4 Marks]

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

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

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

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

Explanation:

The option ((A)–(iv), (B)–(i), (C)–(ii), (D)–(iii)) is the correct match, which is as follows:

- Aptenodytes – Penguin
- Pteropus – Flying fox
- Pterophyllum – Angel fish
- Petromyzon – Lamprey

Question 177.

In cockroach, identify the parts of the foregut in correct sequence:

[4 Marks]

(A) Mouth → Pharynx → Oesophagus → Crop → Gizzard

(B) Mouth → Crop → Pharynx → Oesophagus → Gizzard

(C) Mouth → Gizzard → Crop → Pharynx → Oesophagus

(D) Mouth → Oesophagus → Pharynx → Crop → Gizzard

Explanation:

In cockroach, the parts of the foregut are arranged in the following correct sequence:

Mouth → Pharynx → Oesophagus → Crop → Gizzard

The alimentary canal in the cockroach has three regions: foregut, midgut, and hindgut. The foregut comprises the mouth, which opens into a short tubular pharynx, leading to a narrow tubular passage called the oesophagus. This opens into a sac-like structure called the crop, used for storing food. The crop is followed by the gizzard (proventriculus), which helps in grinding the food particles.

Question 178.

Match the following events that occur in their respective phases of cell cycle and select the correct option:

Column I	Column II
(A) G_1 phase	(i) Cell grows and organelle duplication
(B) S phase	(ii) DNA replication and chromosome duplication
(C) G_2 phase	(iii) Cytoplasmic growth
(D) Metaphase in M-phase	(iv) Alignment of chromosomes

[4 Marks]

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

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

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

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

Explanation:

Option ((A)–(i), (B)–(ii), (C)–(iii), (D)–(iv)) is the correct match, which is as follows:

- In G_1 phase, cell growth and organelle duplication take place.
- In S phase, DNA replication and chromosome duplication occur.
- In G_2 phase, cytoplasmic growth occurs, i.e., proteins are synthesised in preparation for mitosis.
- In the metaphase of M phase, chromosomes are moved to the spindle equator and get aligned along the metaphase plate through spindle fibres.

Question 179.

Bt cotton variety that was developed by the introduction of toxin gene of *Bacillus thuringiensis* (Bt) is resistant to

[4 Marks]

(A) Plant nematodes

(B) Fungal diseases

(C) Insect predators

(D) Insect pests

Explanation:

Btcotton isresistant to cotton ‘bollworn (Insect pest). cry I Ac and cry II Ab genes have been introduced in cotton to protect it from cotton bollworm. This makes Bt cotton as biopesticide.

Question 180.

According to Robert May, the global species diversity is about

[4 Marks]

(A) 1.5 million

(B) 20 million

(C) 7 million

(D) 50 million

Explanation:

Robert May estimated global species diversity at about 7 million. Although some extreme estimates range from 20 to 50 million.