NEET-UG EXAMINATION PAPER-2013

(Solved)

Time allowed : 3 hours | Maximum Marks : 720

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.

In an experiment four quantities a, b, c and d are measured with percentage error 1%, 2%, 3% and 4% respectively.

Quantity P is calculated as follows $P = a^3b^2/cd$ % error in P is:

[4 Marks]

(A) 10%

(B) 7%

(C) 14%

(D) 4%

Explanation:

Given, $P=a^3b^2/cd$

Therefore, $\Delta P/P\times100\%= 3\Delta a/a \times100\%$

$+ 2\ \Delta b/b\times100\%+\Delta c/c \times100\%+ \Delta d/d \times100\% =3x1\%+2\times2\%+3\%+4\%=14\%$

Question 2.

A stone falls freely under gravity. It covers distances h_1, h_2 and h_3 in the first 5 seconds, the next 5 seconds and the next 5 seconds respectively. The relation between h_1, h_2 and h_3 is

[4 Marks]

(A) $h_1=h_2=h_3$

(B) $h_2=3h_1$ and $h_3=3h_2$

(C) $h_1=h_2/3=h_3/5$

(D) $h_1=2h_2=3h_3$

Explanation:

$\therefore h=1/2gt^2$

$\therefore h_1=1/2g(5)^2=125$

$h_1+h_2=1/2g(10)^2=500$

$\Rightarrow h_2=375$

$h_1+h_2+h_3 =1/2g(15)^2=1125$

$\Rightarrow h_3 =625$

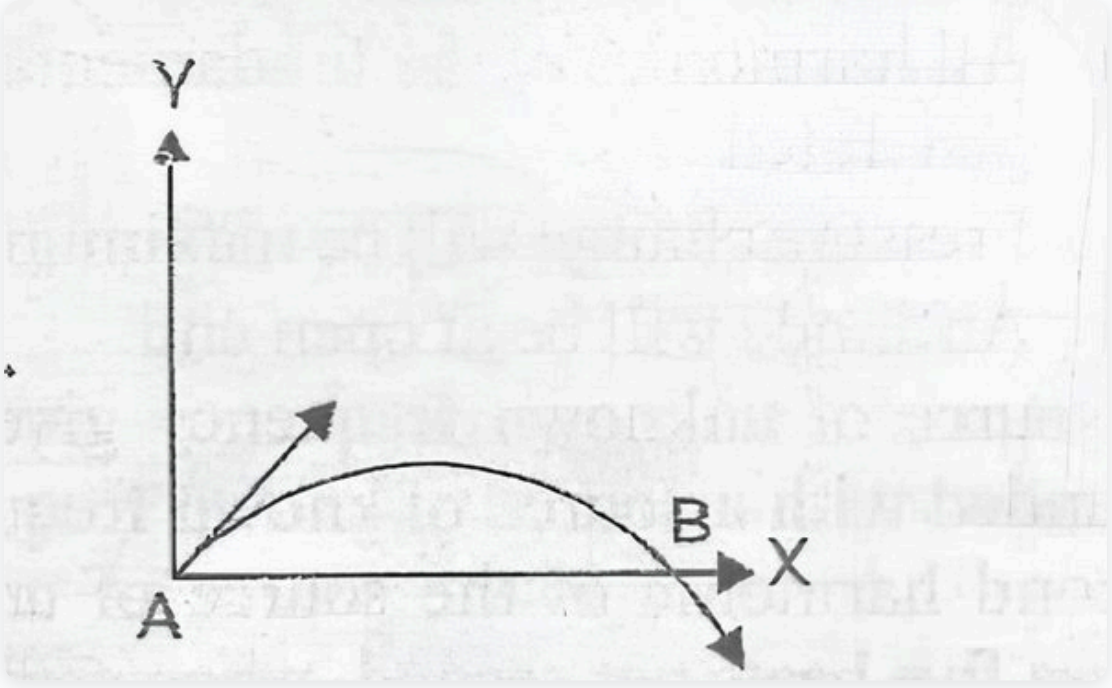
$h_2= 3h_1, h_3 =5h_1$

or $h_1=h_2/3=h_3/5$

Question 3.

The velocity of a projectile at the initial point A is $(2\hat{i} + 3\hat{j})$ m/s. It's velocity (in m/s) at point B is

[4 Marks]



(A) -2î - 3ĵ

(B) 2î + 3ĵ

(C) 2î - 3ĵ

(D) -2î + 3ĵ

Explanation:

At point B the direction of velocity component of the projectile along y-component reverses, while the x-component remains unchanged.

Hence, □□_B = 2î - 3ĵ

Question 4.

The upper half of an inclined plane of inclination θ is perfectly smooth while lower half is rough. A block starting from rest at the top of the plane will again come to rest at the bottom, if the coefficient of friction between the block and lower half of the plane is given by

[4 Marks]

(A) μ = 2 / tan θ

(B) μ = 1 / tan θ

(C) μ = 2 tan θ

(D) μ = tan θ

Explanation:

For upper half of inclined plane

$v^2 = u^2 + 2a\ S/2 = 2\ (g \sin \theta)\ S/2 = gS \sin \theta$

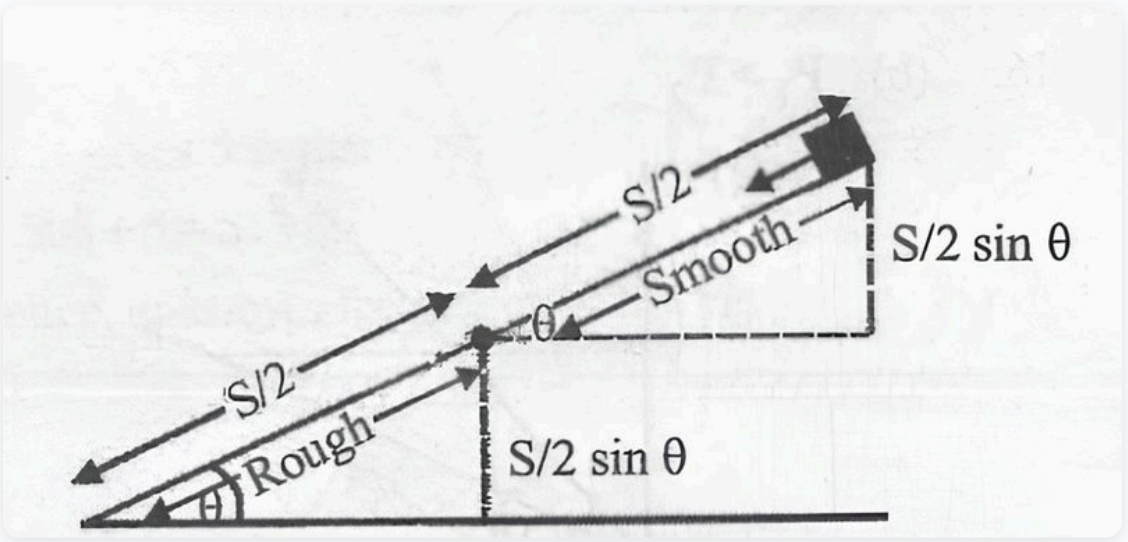
For lower half of inclined plane

$0 = u^2 + 2\ g\ (\sin \theta - \mu \cos \theta)\ S/2$

$\Rightarrow - gS \sin \theta = gS\ (\ \sin\theta - \mu \cos \theta)$

$\Rightarrow 2 \sin \theta = \mu \cos \theta$

$\Rightarrow \mu = 2 \sin \theta / \cos \theta = 2 \tan \theta$



Question 5.

A uniform force of $(3\hat{i} + \hat{j})$ newton acts on a particle of mass 2 kg. The particle is displaced from position $(2\hat{i} + \hat{k})$ meter to position $(4\hat{i} + 3\hat{j} - \hat{k})$ meter. The work done by the force on the particle is

[4 Marks]

(A) 6 J

(B) 15 J

(C) 9 J

(D) 13 J

Explanation:

Given : $\square\square = 3\hat{i} + \hat{j}$

$\square\square = (2\hat{i} + \hat{k})$, $\square\square_2 = (4\hat{i} + 3\hat{j} - \square\square)$

$\square\square = \square\square_2 - \square\square_1 = (4\hat{i} + 3\hat{j} - \square\square) - (2\hat{i} + \hat{k})$

or $\square\square = 2\hat{i} + 3\hat{j} - 2\hat{k}$

So work done by the given force, $w = \square\square \cdot \square\square$

$= (3\hat{i} + \hat{j}) \cdot (2\hat{i} + 3\hat{j} - 2\hat{k}) = 6 + 3 = 9J$

Question 6.

An explosion breaks a rock into three parts in a horizontal plane. Two of them go off at right angles to each other. The first part of mass 1 kg moves with a speed of 12 ms^{-1} and the second part of mass 2 kg moves with speed 8 ms^{-1}. If the third part flies off with speed 4 ms^{-1} then its mass is

[4 Marks]

(A) 3kg

(B) 7kg

(C) 17kg

(D) 5kg

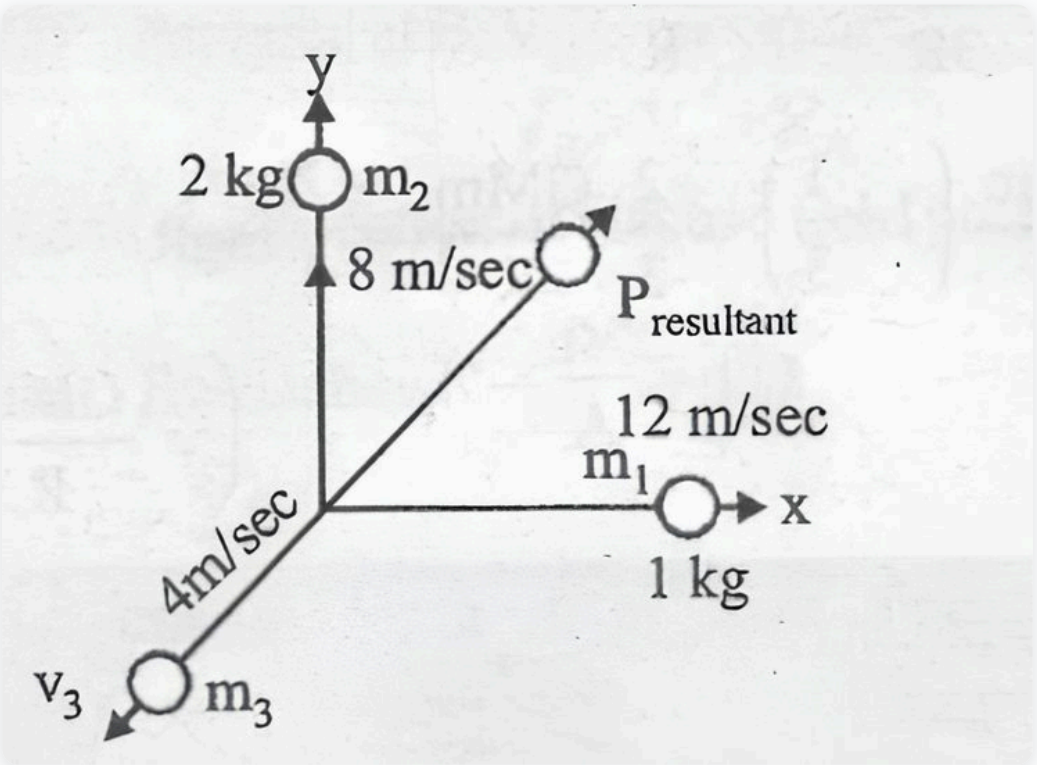
Explanation:

P_resultant = $\sqrt{12^2 + 16^2}$

= $\sqrt{144 + 256} = 20$

m_3v_3 = 20 (momentum of third part)

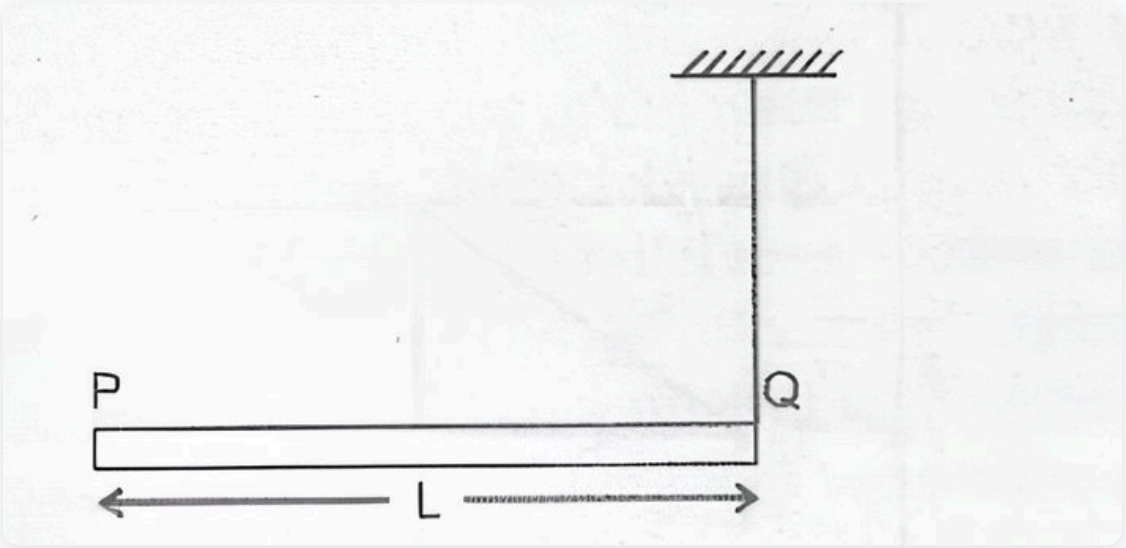
or, m_3 = 20/4 = 5 kg



Question 7.

A rod PQ of mass M and length Lis hinged at end P. The rod is kept horizontal by a massless string tied to point Q as shown in figure. When string is cut, the initial angular acceleration of the rod is

[4 Marks]



(A) 3g/2L

(B) 2g/3L

(C) 2g/L

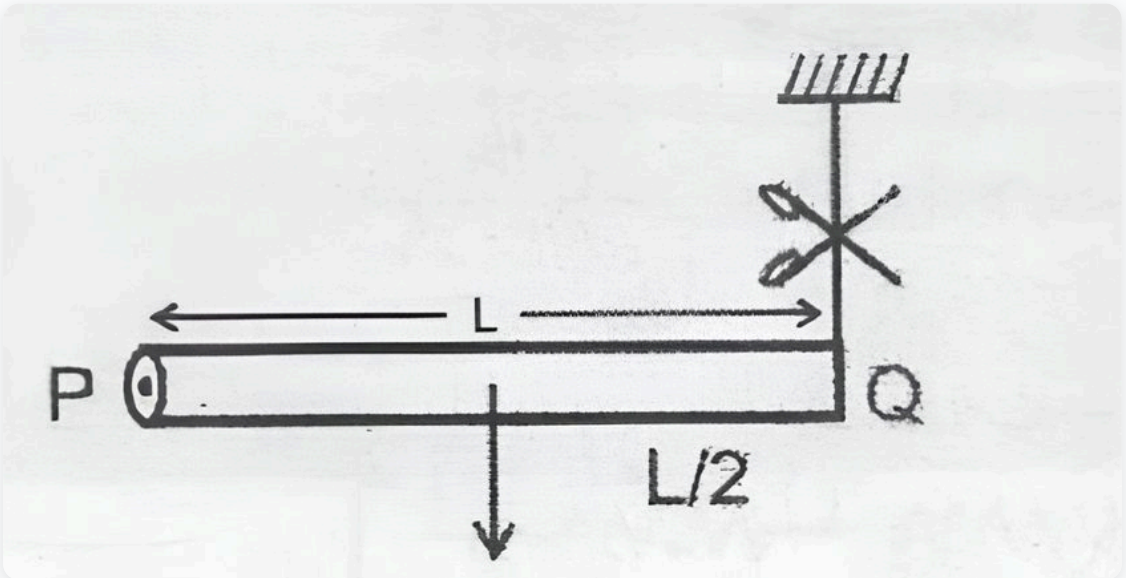
(D) g/L

Explanation:

Weight of the rod will produce the torque

τ = mg L / 2 = I α = m L^2 / 3) α [∵ Irod = M L^2 / 3]

Hence, angular acceleration, α = 3g / 2L



Question 8.

A small object of uniform density rolls up a curved surface with an initial velocity 'v'. It reaches upto a maximum height of $3v^2 / 4g$ with respect to the initial position. The object is a

[4 Marks]

(A) solid sphere

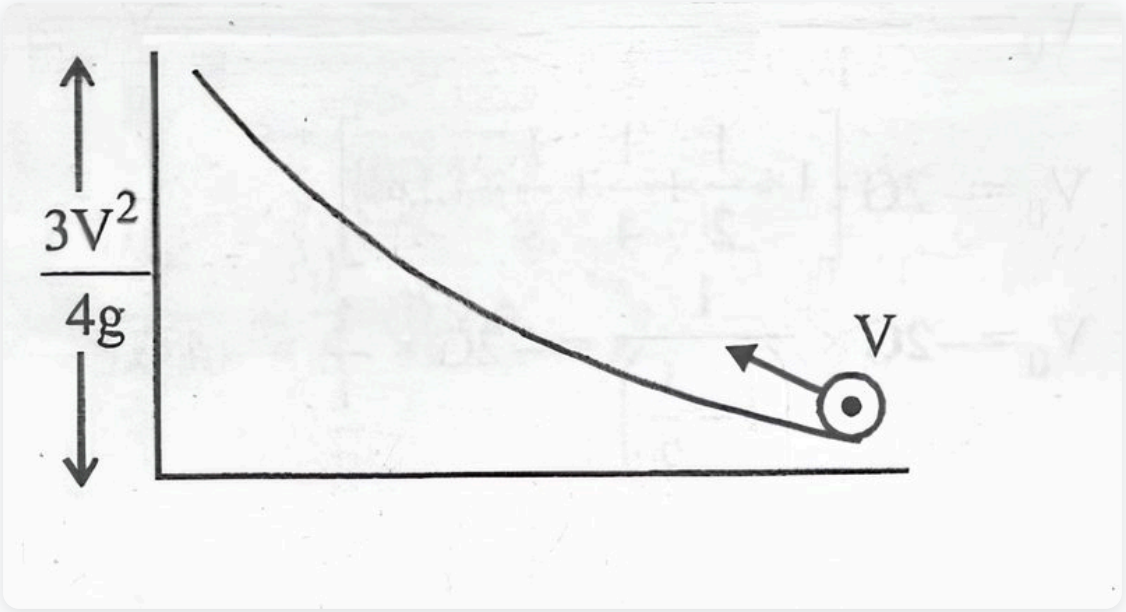
(B) hollow sphere

(C) disc

(D) ring

Explanation:

From law of conservation of mechanical energy,
$\Rightarrow 1/2\ I\omega^2 + 0 + 1/2\ mv^2 = mg \times 3v^2/4g$
$\Rightarrow 1/2\ I\omega^2 = 3/4\ mv^2 - 1/2\ mv^2$
$\Rightarrow 1/2\ I\omega^2 = mv^2/2\ (3/2 - 1)$
or, $1/2\ I\ (V^2/R^2) = mv^2/4$ or, $I = 1/2\ mR^2$
Hence, object is a disc.



Question 9.

A body of mass 'm' is taken from the earth's surface to the height equal to twice the radius (R) of the earth. The change in potential energy of body will be

[4 Marks]

(A) 1/3 mgR

(B) mg2R

(C) 3 mgR

(D) 2/3 mgR

Explanation:

Initial P.E., $U_i = -GMm / R$,

Final P.E., $U_f = -GMm / 3R$ [∴ R' = R + 2R = 3R]

∴ Change in potential energy,

$\Delta U = -GMm / 3R + GMm / R$

$= GMm / R (1 - 1/3) = 2/3\ GMm / R = 2/3\ mgR$

(∴ GMm / R = mgR)

Question 10.

Infinite number of bodies, each of mass 2 kg are situated on x-axis at distances 1m, 2m, 4m, 8m, ... respectively, from the origin. The resulting gravitational potential due to this system at the origin will be

[4 Marks]

(A) - G

(B) - 4 G

(C) - 8/3 G

(D) - 4/3 G

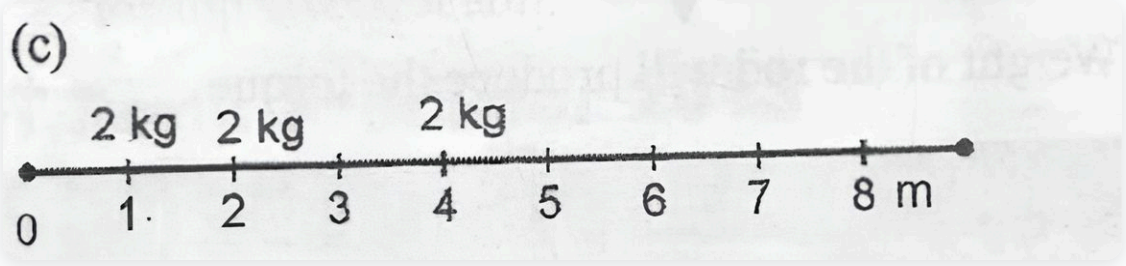
Explanation:

Gravitational potential V = -Gm / r

$V_0 = - Gx2 / 1 - Gx2 / 2 - Gx2 / 4 - Gx2 / 8$ ----∞

$V_0 = -2G [1 + 1/2 + 1/4 + 1/8 + ...∞]$

$V_0 = -2G \times 1 / (1 - 1/2) = -2G \times 1 / (1/2) = -4G$



Question 11.

The following four wires are made of the same material. Which of these will have the largest extension when the same tension is applied?

[4 Marks]

(A) Length = 300 cm, diameter = 3 mm

(B) Length = 100 cm, diameter = 1 mm

(C) Length = 200 cm, diameter = 2 mm

(D) Length = 50 cm, diameter = 0.5 mm

Explanation:

$F = YA / L \times \Delta L$

So, extension, $\Delta L \propto L / A \propto L / D^2$
[$\because$ F and Y are constant]

$\Delta L_1 \propto 100 / 1^2 \propto 100$ and $\Delta L_2 \propto 200 / 2^2 \propto 50$

$\Delta L_3 \propto 300 / 3^2 \propto 100 / 3$ and $\Delta L_4 \propto 50 / (1/4) \propto 200$

The ratio of L / D^2 is maximum for case (d).

Question 12.

The wetability of a surface by a liquid depends primarily on

[4 Marks]

(A) angle of contact between the surface and the liquid

(B) viscosity

(C) surface tension

(D) density

Explanation:

Wetability of a surface by a liquid primarily depends on angle of contact between the surface and liquid.

If angle of contact is acute liquids wet the solid and vice-versa

Question 13.

A piece of iron is heated in a flame. It first becomes dull red, then becomes reddish yellow and finally turns to white hot. The correct explanation for the above observation is possible by using

[4 Marks]

(A) Kirchhoff's law

(B) Wien's displacement law

(C) Newton's law of cooling

(D) Stefan's law

Explanation:

Wein's displacement law
According to this law

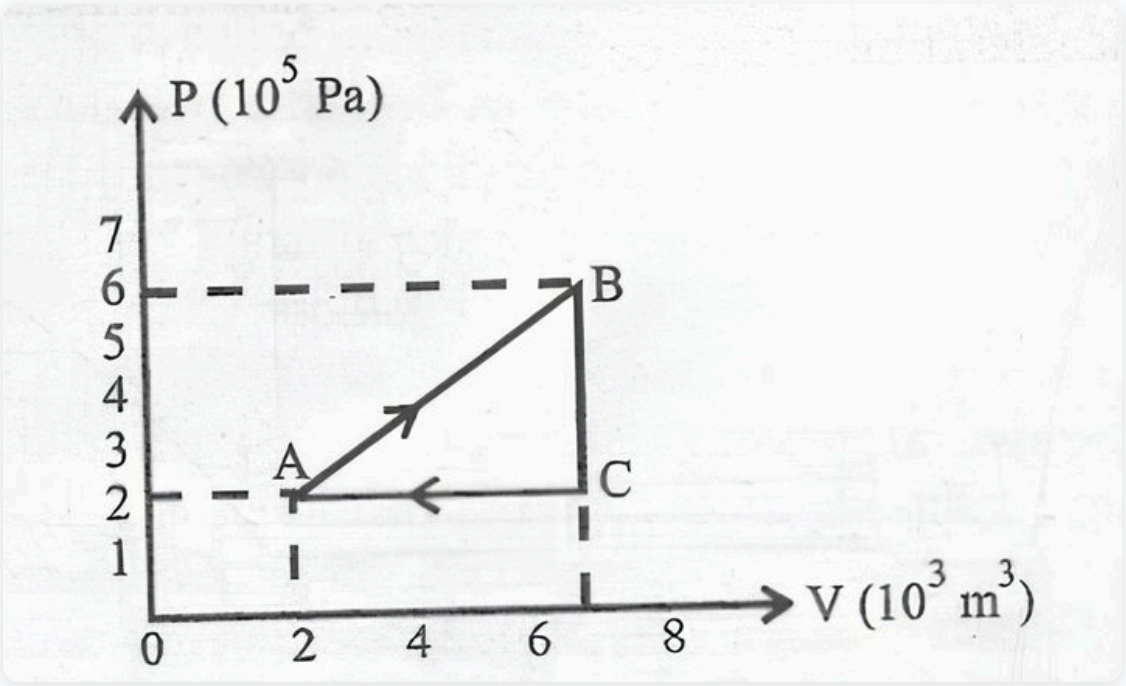
$\lambda_{max} \propto 1/T$

or, $\lambda_{max} \times T$ = constant
So, as the temperature increases λ decreases.

Question 14.

A gas is taken through the cycle A → B → C → A, as shown in figure. What is the net work done by the gas?

[4 Marks]



(A) - 2000 J

(B) 2000 J

(C) 1000 J

(D) zero

Explanation:

W_net = Area of triangle ABC
= 1/2 AC × BC
= 1/2 × 5 × 10^-3 × 4 × 10^5 = 1000 J

Question 15.

During an adiabatic process, the pressure of a gas is found to be proportional to the cube of its temperature. The ratio of Cp / Cv for the gas is

[4 Marks]

(A) 3/2

(B) 4/3

(C) 2

(D) 5/3

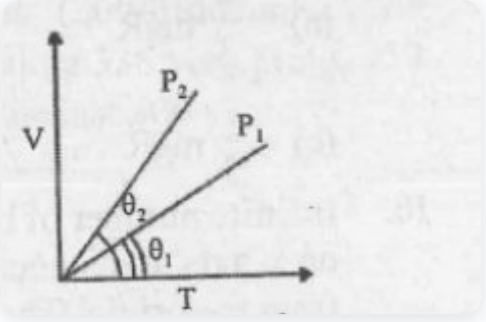
Explanation:

According to question P ∝ T^3
But as we know for an adiabatic process the pressure P
∝ T^γ/γ-1.
So, γ/γ-1= 3 ⇒ γ = 3/2 or, C_p/C_v = 3/2

Question 16.

In the given (V - T) diagram, what is the relation between pressure P_1 and P_2?

[4 Marks]



(A) $P_2 < P_1$

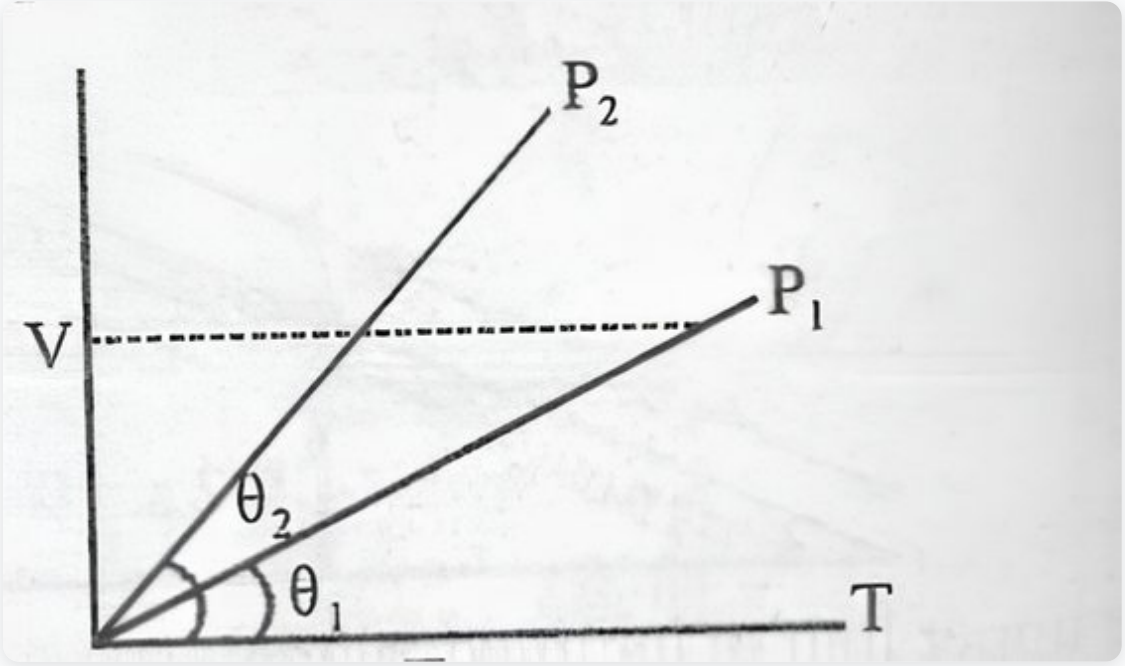
(B) $P_2 > P_1$

(C) Cannot be predicted

(D) $P_2 = P_1$

Explanation:

As V = constant ⇒ P ∝ T
Hence from V–T graph P1 > P2



Question 17.

The amount of heat energy required to raise the temperature of 1g of Helium at NTP, from T_1 K to T_2 K is

[4 Marks]

(A) 3/8 N_a k_B(T2 - T1)

(B) 3/4 N_ak_B (T2 / T1)

(C) 3/2 N_a k_B(T2 - T1)

(D) 3/4 N_a k_B(T2 - T1)

Explanation:

From first law of thermodynamics,

ΔQ = ΔU + ΔW = 3/2 . 1/4 R(T2 - T1) + 0

= 3/8 N_aK_B(T2 - T1) [∵ K = R/N]

Question 18.

The molar specific heats of an ideal gas at constant pressure and volume are denoted by C_p and C_v, respectively. If γ = Cp / Cv and R is the universal gas constant, then C_v is equal to

[4 Marks]

(A) 1 + γ / 1 - γ

(B) (γ - 1) / R

(C) γR

(D) R / (γ- 1)

Explanation:

C_p - C_v = R ⇒ C_p = C_v + R

∴ γ = C_p / C_v = (C_v + R) / C_v = C_v / C_v + R / C_v

⇒ γ = 1 + R / C_v ⇒ R / C_v = γ - 1

⇒ C_v = R / (γ - 1)

Question 19.

A wave travelling in the +ve x-direction having displacement along y-direction as 1m, wavelength 2π m and frequency 1/π Hz is represented by

[4 Marks]

(A) y = sin (x - 2t)

(B) y = sin (2π x + 2π t)

(C) y = sin (10π x - 20π t)

(D) y = sin (2π x - 2π t)

Explanation:

The standard equation of a wave travelling along x-axis (+ve direction) is given by, Y = A sin (kx - ωt) where,
angular frequency, ω= 2πf
⇒ 2π/π = 2 [∴f = 1/π]

angular wave number, k = 2π/λ ⇒ 2π/2π= 1 [∴λ= 2π]
∴ Y = 1 sin (x - 2t) [∴ Amplitude, A = 1 m]

Question 20.

If we study the vibration of a pipe open at both ends, then which of the following statements is not true?

[4 Marks]

(A) Antinode will be at open end

(B) Pressure change will be maximum at both ends

(C) All harmonics of the fundamental frequency will be generated

(D) Odd harmonics of the fundamental frequency will be generated

Explanation:

Pressure change will be minimum at both ends. In fact, pressure variation is maximum at l/2 because the displacement node is pressure antinode.

Question 21.

A source of unknown frequency gives 4 beats/s, when sounded with a source of known frequency 250 Hz. The second harmonic of the source of unknown frequency gives five beats per second, when sounded with a source of frequency 513 Hz. The unknown frequency is

[4 Marks]

(A) 254 Hz

(B) 240 Hz

(C) 246 Hz

(D) 260 Hz

Explanation:

When sounded with a source of known frequency fundamental frequency = 250 ±4 Hz = 254 Hz or 246 Hz

2^{nd} harmonic if unknown frequency (suppose) 254 Hz = 2 x 254 = 508 Hz

As it gives 5 beats

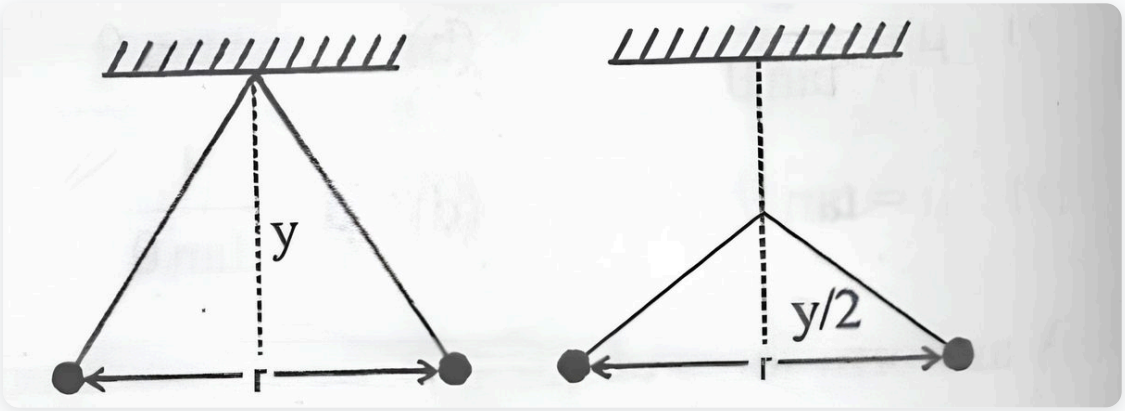
∴508 + 5 = 513 Hz

Hence, unknown frequency is 254 Hz

Question 22.

Two pith balls carrying equal charges are suspended from a common point by strings of equal length. The equilibrium separation between them is r. Now the strings are rigidly clamped at half the height. The equilibrium separation between the balls now become

[4 Marks]



(A) □2r /√3□

(B) □r/^3√2 □

(C) □2r / 3□

(D) □r /√2□^2

Explanation:

T cos θ = mg

T sin θ = F

∴ tan θ = F / mg

From figure, tan θ = Fe / mg

=> (r / 2) / y = (kq^2 / r^2) / mg

[∵ F = kq^2 / r^2 from coulomb's law]

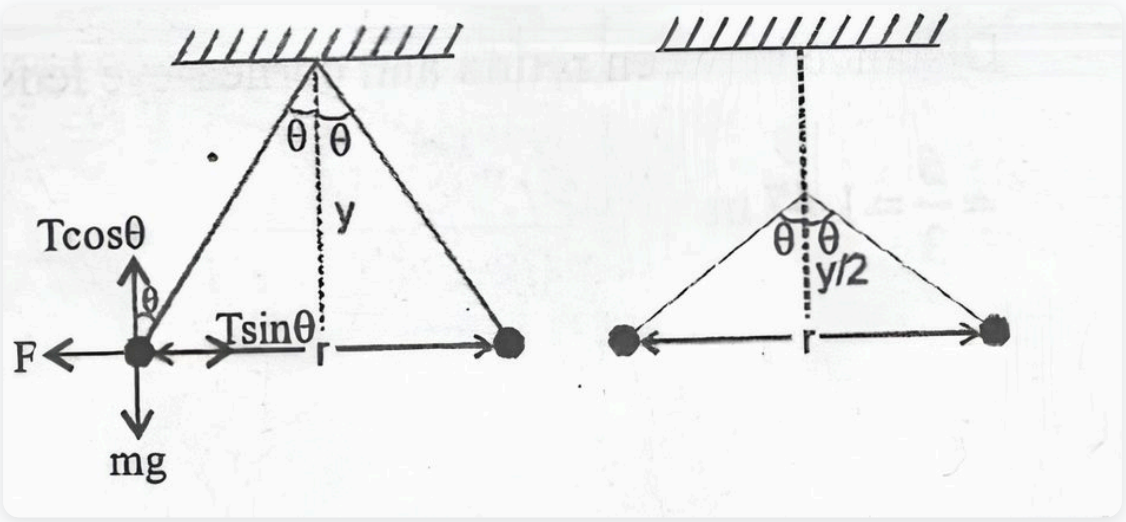
=> r^3 ∝ y

When string is clamped at half the height

r'^3 ∝ y / 2

Dividing the above two equations, we have

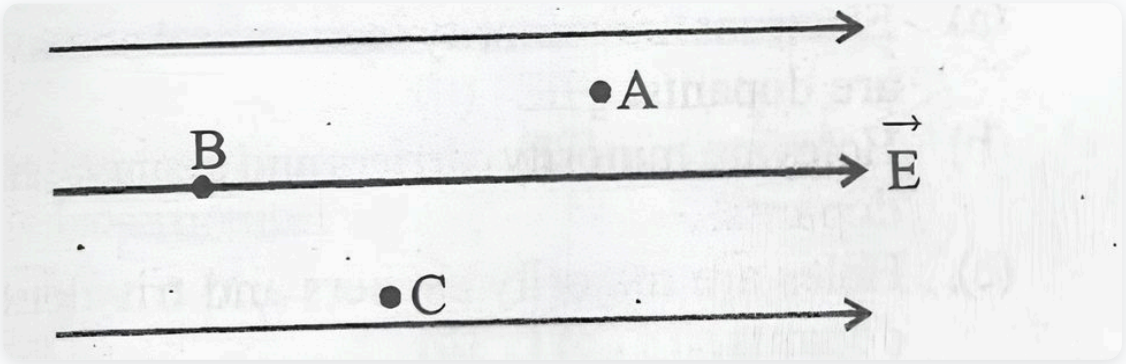
r' / r = 1 / 2^(1/3) => r' = r / ³√2



Question 23.

A, B and C are three points in a uniform electric field. The electric potential is

[4 Marks]



(A) maximum at A

(B) maximum at C

(C) same at all the three points A,B and C

(D) maximum at B

Explanation:

Potential at B, V_B is maximum

V_B > V_C > V_A

As in the direction of electric field potential decreases.

Question 24.

A wire of resistance 4 Ω is stretched to twice its original length. The resistance of stretched wire would be

[4 Marks]

(A) 4 Ω

(B) 8 Ω

(C) 2 Ω

(D) 16 Ω

Explanation:

Resistance $R = \rho\ell / A = 4\ \Omega$

$\therefore \ell' = 2\ell$

On stretching, volume of wire remains constant

$\therefore \ell A' = \ell' A'$

$\therefore A' = A / 2$

$\therefore R' = \rho(2\ell) / (A / 2) = 4R = 4 \times 4\ \Omega = 16\ \Omega \Rightarrow \ell A = 2\ell A'$

Question 25.

The resistance of the four arms P, Q, R and S in a Wheatstone's bridge are 10 ohm, 30 ohm, 10 ohm and 90 ohm, respectively. The e.m.f. and internal resistance of the cell are 7 volt and 5 ohm respectively. If the galvanometer resistance is 50 ohm, the current drawn from the cell will be

[4 Marks]

(A) 0.2 A

(B) 2.0 A

(C) 0.1 A

(D) 1.0 A

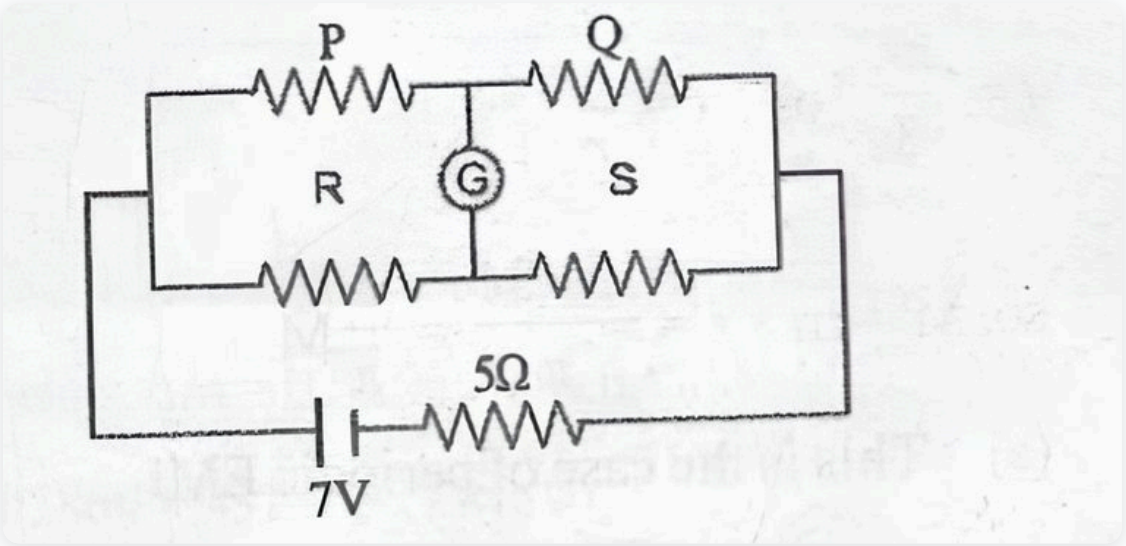
Explanation:

Given : V = 7V
r = 5Ω

$R_{eq} = (40 \times 120) / (40 + 120)\ \Omega$

$I = V / R = 7 / (5 + (40 \times 120) / (40 + 120))$

$= 7 / (5 + 30) = 1 / 5 = 0.2$ A.



Question 26.

When a proton is released from rest in a room, it starts with an initial acceleration a_0 towards west. When it is projected towards north with a speed v_0 it moves with an initial acceleration $3a_0$towards west. The electric and magnetic fields in the room are respectively

[4 Marks]

(A) ma_0 / e west, $2ma_0$/ ev_0 up

(B) ma_0 / e east, $3ma_0$ / ev_0 down

(C) ma_0 / e east, $3ma_0$/ ev_0 up

(D) ma_0 / e west, $2ma_0$ / ev_0 down

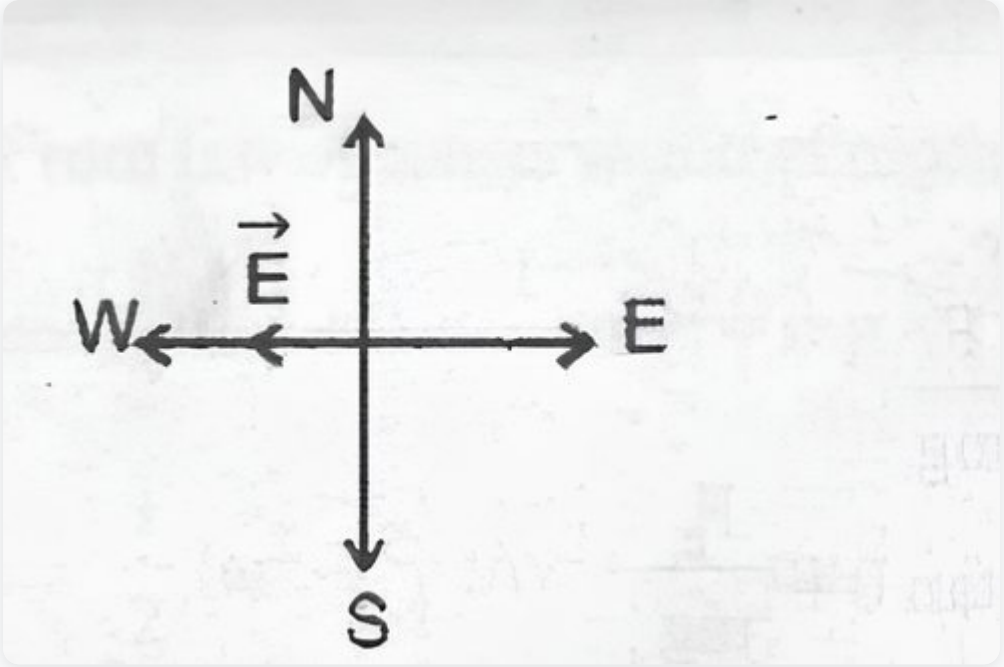
Explanation:

When moves with an acceleration a_0 towards west, electric field

$E = F/q = ma_0/e$ (West)

When moves with an acceleration $3a_0$ towards east, magnetic field

$B = 2ma_0/ev_0$ (downward)



Question 27.

A current loop in a magnetic field

[4 Marks]

(A) can be in equilibrium in one orientation

(B) can be in equilibrium in two orientations, both the equilibrium states are unstable

(C) can be in equilibrium in two orientations, one stable while the other is unstable

(D) experiences a torque whether the field is uniform or non-uniform in all orientations

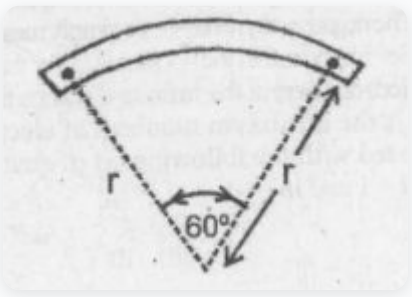
Explanation:

A current loop in a magnetic field is in equilibrium in two orientations one is stable and another unstable.

Question 28.

A bar magnet of length 'l' and magnetic dipole moment 'M' is bent in the form of an arc as shown in figure. The new magnetic dipole moment will be

[4 Marks]



(A) M

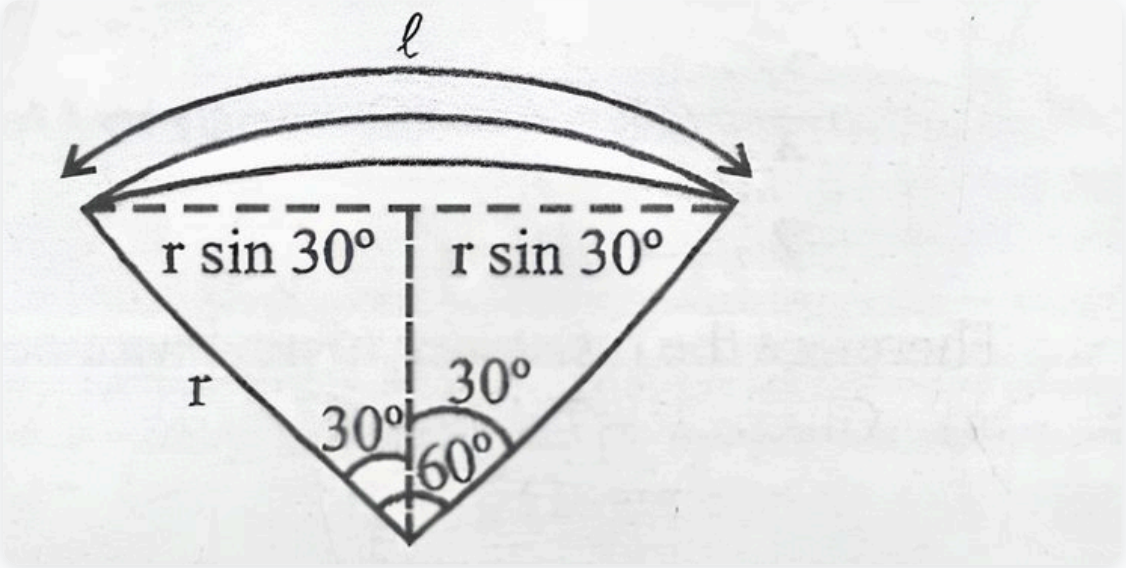
(B) 2πM

(C) 3/πM

(D) M/2

Explanation:

Magnetic dipole moment
M = m × ℓ M' = m × r
From figure
ℓ = πr / 3 or r = 3ℓ / π
so, M' = m × r = m × 3ℓ / π = 3 / π M



Question 29.

A wire loop is rotated in a magnetic field. The frequency of change of direction of the induced e.m.f. is

[4 Marks]

(A) four times per revolution

(B) twice per revolution

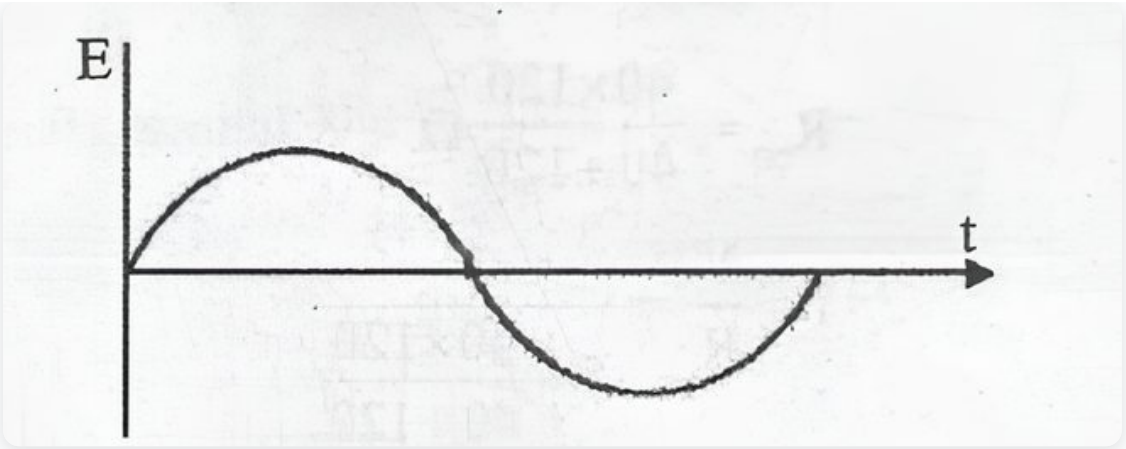
(C) once per revolution

(D) six times per revolution

Explanation:

This is the case of periodic EMI

From graph, it is clear that direction is changing once in 1/2 cycle.



Question 30.

A coil of self-inductance L is connected in series with a bulb B and an AC source. Brightness of the bulb decreases when

[4 Marks]

(A) a capacitance of reactance X_c = X_L is included in the same circuit

(B) frequency of the AC source is decreased

(C) an iron rod is inserted in the coil

(D) number of turns in the coil is reduced

Explanation:

By inserting iron rod in the coil,
L ↑ Z ↑ I ↓ so brightness ↓

Question 31.

The condition under which a microwave oven heats up a food item containing water molecules most efficiently is

[4 Marks]

(A) the frequency of the microwaves must match the resonant frequency of the water molecules.

(B) infra-red waves produce heating in a microwave oven.

(C) the frequency of the microwaves has no relation with natural frequency of water molecules.

(D) microwaves are heat waves, so always produce heating.

Explanation:

Required condition : Frequency of microwaves =Resonant frequency of water molecules.

Question 32.

A plano convex lens fits exactly into a plano concave lens. Their plane surfaces are parallel to each other. If lenses are made of different materials of refractive indices μ_1 and μ_2 and R is the radius of curvature of the curved surface of the lenses, then the focal length of the combination is

[4 Marks]

(A) $R / (\mu_1 - \mu_2)$

(B) $R / 2(\mu_1 - \mu_2)$

(C) $2R / (\mu_2 - \mu_1)$

(D) $R / 2(\mu_1 + \mu_2)$

Explanation:

From the question,

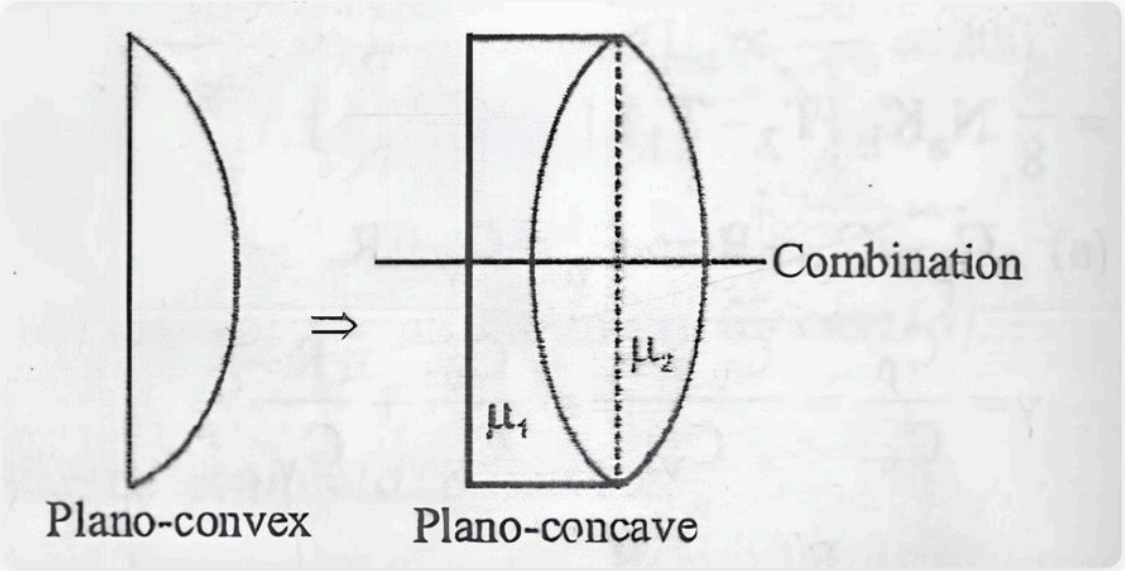
$1/f = 1/f1 + 1/f2$

$= (\mu_1 - 1) (1/\infty - 1/-R) + (\mu_2 - 1) (1/\infty - 1/R)$

$= (\mu_1 - 1)/R - (\mu_2 - 1)/R \Rightarrow 1/f = (\mu_1 - \mu_2)/R$

$\Rightarrow f = R / (\mu_1 - \mu_2)$

Hence, focal length of the combination is$=R/ \mu_1 - \mu_2$



Question 33.

For a normal eye, the cornea of eye provides a converging power of 40D and the least converging power of the eye lens behind the cornea is 20D. Using this information, the distance between the retina and the eye lens of the eye can be estimated to be

[4 Marks]

(A) 1.67 cm

(B) 2.5 cm

(C) 1.5 cm

(D) 5 cm

Explanation:

P_cornea = +40 D
P_e = +20 D
Total power of combination = 40 + 20 = 60 D

Focal length of combination = 1/60 × 100 cm

= 5/3 cm

For minimum converging state of eye lens,

u = -∞ v = ? f = 5/3

From lens formula,

1/f = 1/v - 1/u ⇒ v = 5/3 cm

Distance between retina and cornea-eye lens

= 5/3 = 1.67 m

Question 34.

In Young's double slit experiment, the slits are 2 mm apart and are illuminated by photons of two wavelengths λ_1 = 12000Å and λ_2 = 10000Å. At what minimum distance from the common central bright fringe on the screen 2 m from the slit will a bright fringe from one interference pattern coincide with a bright fringe from the other ?

[4 Marks]

(A) 8mm

(B) 3mm

(C) 6mm

(D) 4mm

Explanation:

$\because Y = n\lambda D / d$

$\therefore n_1\lambda_1 = n_2\lambda_2$

$\Rightarrow n_1 \times 12000 \times 10^{-10} = n_2 \times 10000 \times 10^{-10}$

or, $n\,(12000 \times 10^{-10}) = (n + 1)\,(10000 \times 10^{-10})$

$\Rightarrow n = 5$

($\because \lambda_1 = 12000 \times 10^{-10}$ m; $\lambda_2 = 10000 \times 10^{-10}$ m)

Hence, $Y_{common} = n\lambda_1 D / d$

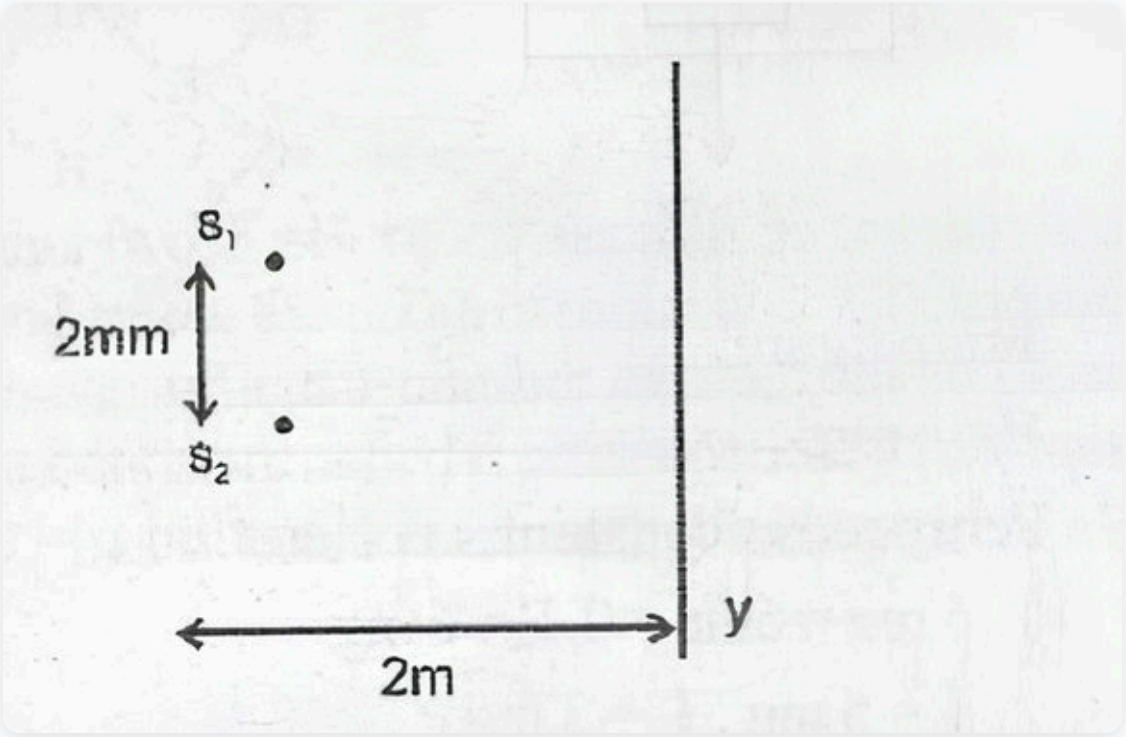
$$= \frac{5(12000 \times 10^{-10}) \times 2}{2 \times 10^{-3}}$$

($\because$ d = 2 mm and D = 2m)

$= 5 \times 12 \times 10^{-4}$ m

$= 60 \times 10^{-4}$ m

$= 6 \times 10^{-3}$ m = 6 mm



Question 35.

A parallel beam of fast moving electrons is incident normally on a narrow slit. A fluorescent screen is placed at a large distance from the slit. If the speed of the electrons is increased, which of the following statements is correct ?

[4 Marks]

(A) Diffraction pattern is not observed on the screen in case of electrons.

(B) The angular width of the central maximum will be unaffected

(C) The angular width of the central maximum will decrease.

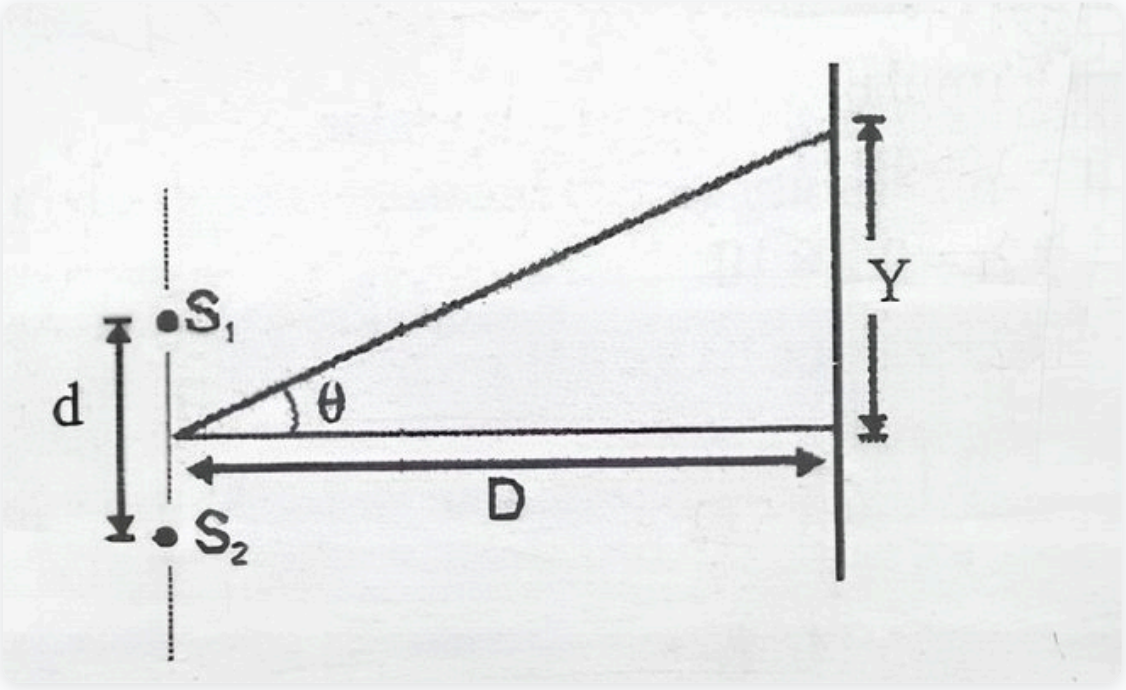
(D) The angular width of the central maximum of the diffraction pattern will increase.

Explanation:

Angular width, $\theta = Y/D = n\lambda D/dD$ [$\because Y = D\lambda/d$]

so, $\theta = \lambda/d$, $v \uparrow \lambda \downarrow \theta \downarrow$

[For central maxima n = 1]
Hence, with increase in speed of electrons angular width of central maximum decreases.



Question 36.

The wavelength λ_e of an electron and λ_p of a photon are of same energy E are related by

[4 Marks]

(A) $\lambda_p \propto \lambda_e$

(B) $\lambda_p \propto \sqrt{\lambda_e}$

(C) $\lambda_p \propto 1 / \sqrt{\lambda_e}$

(D) $\lambda_p \propto \lambda_e^2$

Explanation:

As P = E/c

$\lambda p = hc/E$ ...(i)

$\lambda e = h / \sqrt{(2mE)} \Rightarrow \lambda e^2 = h^2 / 2mE$ ...(ii)

From equations (i) and (ii)
$\lambda p \propto \lambda e^2$

Question 37.

For photoelectric emission from certain metal the cut-off frequency is ν. If radiation of frequency 2ν impinges on the metal plate, the maximum possible velocity of the emitted electron will be (m is the electron mass)

[4 Marks]

(A) $2\sqrt{(h\nu / m)}$

(B) $\sqrt{(2h\nu / m)}$

(C) $\sqrt{(h\nu / m)}$

(D) $\sqrt{(h\nu / (2m)}$

Explanation:

From photo-electric equation,
hv' = hv + K_max ...(i)

h.2v = hv + 1/2 mV^2_max [.'. v' = 2 v]

⇒ hv = 1/2 mV^2_max ⇒ V_max = √(2hv/m)

Question 38.

In the spectrum of hydrogen, the ratio of the longest wavelength in the Lyman series to the longest wavelength in the Balmer series is

[4 Marks]

(A) 27/5

(B) 4/9

(C) 9/4

(D) 5/27

Explanation:

For Lyman series (2 → 1)

$1/\lambda_L = R [1 - 1/2^2] = 3R/4$

For Balmer series (3 → 2)

$1/\lambda_B = R [1/4 - 1/9] = 5R/36$

$\Rightarrow \lambda_L / \lambda_B = (4 / 3R) / (36 / 5R) = 4/36 (5/3) = 5/27$

Question 39.

A certain mass of Hydrogen is changed to Helium by the process of fusion. The mass defect in fusion reaction is 0.02866 a.m.u. The energy liberated per a.m.u. is (Given : 1 a.m.u = 931 MeV)

[4 Marks]

(A) 26.7 MeV

(B) 13.35 MeV

(C) 2.67 MeV

(D) 6.675 MeV

Explanation:

Mass defect Δm = 0.02866 a.m.u.
Energy = 0.02866 × 931 = 26.7 MeV
As $_1H^2 + _1H^2 \rightarrow _2He^4$
Energy liberated per a.m.u = 13.35/2 MeV
= 6.675 MeV

Question 40.

The half life of a radioactive isotope 'X' is 20 years. It decays to another element 'Y' which is stable. The two elements 'X' and 'Y' were found to be in the ratio of 1 : 7 in a sample of a the given rock. The age of the rock is estimated to be

[4 Marks]

(A) 40 years

(B) 100 years

(C) 80 years

(D) 60 years

Explanation:

The value of x is 1/8
$= x_0/8 = x_0/2^3 \Rightarrow t = 3T = 3 \times 20 = 60$ years

Hence the estimated age of the rock is 60 years
$X \rightarrow Y_0$
at t = 0 N_0 0
at t = t N N_0-N

Question 41.

In a n-type semiconductor, which of the following statement is true?

[4 Marks]

(A) Electrons are minority carriers and pentavalent atoms are dopants.

(B) Holes are majority carriers and trivalent atoms are dopants.

(C) Holes are minority carriers and pentavalent atoms are dopants.

(D) Electrons are majority carriers and trivalent atoms are dopants.

Explanation:

In a n-type semiconductor holes are minority carriers and pentavalent atoms are dopants.

Question 42.

In a common emitter (CE) amplifier having a voltage gain G, the transistor used has transconductance 0.03 mho and current gain 25. If the above transistor is replaced with another one with transconductance 0.02 mho and current gain 20, the voltage gain will be

[4 Marks]

(A) 1.5G

(B) 1/3 G

(C) 2/3 G

(D) 5/4 G

Explanation:

Voltage gain Av = β (R_out / R_in)

⇒ G = 25 R_out / R_in ...(i)

Transconductance g_m = β / R_in

⇒R_in = β / g_m = 25 / 0.03

Putting this value of R_in in eqn. (i)

G = 25 R_out / 25 × 0.03 ...(ii)

∴ G' = 20 R_out / 20× 0.02 ...(iii)

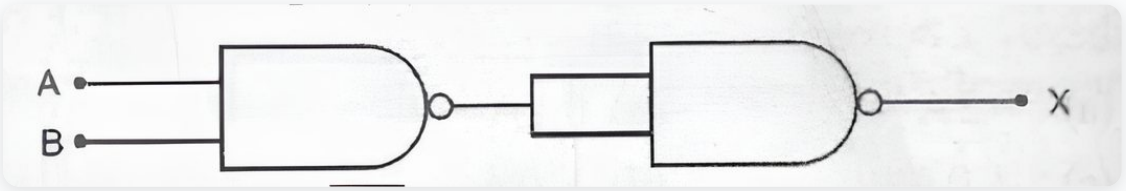
From eqs. (ii) and (iii)

Voltage gain of new transistor G' = 2/3 G

Question 43.

The output(X) of the logic circuit shown in figure will be

[4 Marks]



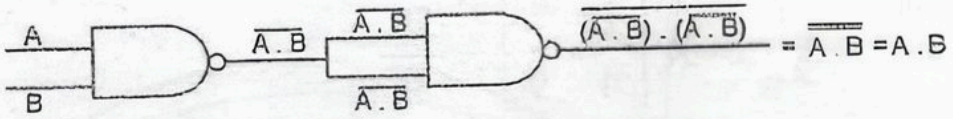
(A) X = overline(A+B)

(B) X = overline overline(A) + overline B

(C) X = A.B

(D) X = overline(A.B)

Explanation:



i.e., output $X = A.B$

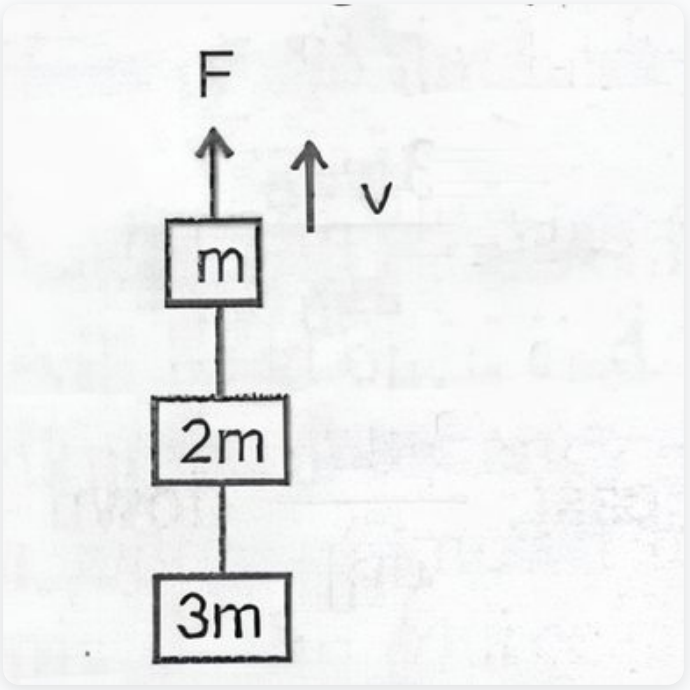
Truth Table

A	B	X
0	0	0
1	0	0
0	1	0
1	1	1

Question 44.

Three blocks with masses m, 2 m and 3 m are connected by strings as shown in the figure. After an upward force F is applied on block m, the masses move upward at constant speed v. What is the net force on the block of mass 2m? (g is the acceleration due to gravity)

[4 Marks]



(A) 2 mg

(B) 3 mg

(C) 6 mg

(D) zero

Explanation:

From figure

F = 6 mg,

As speed is constant, acceleration a = 0

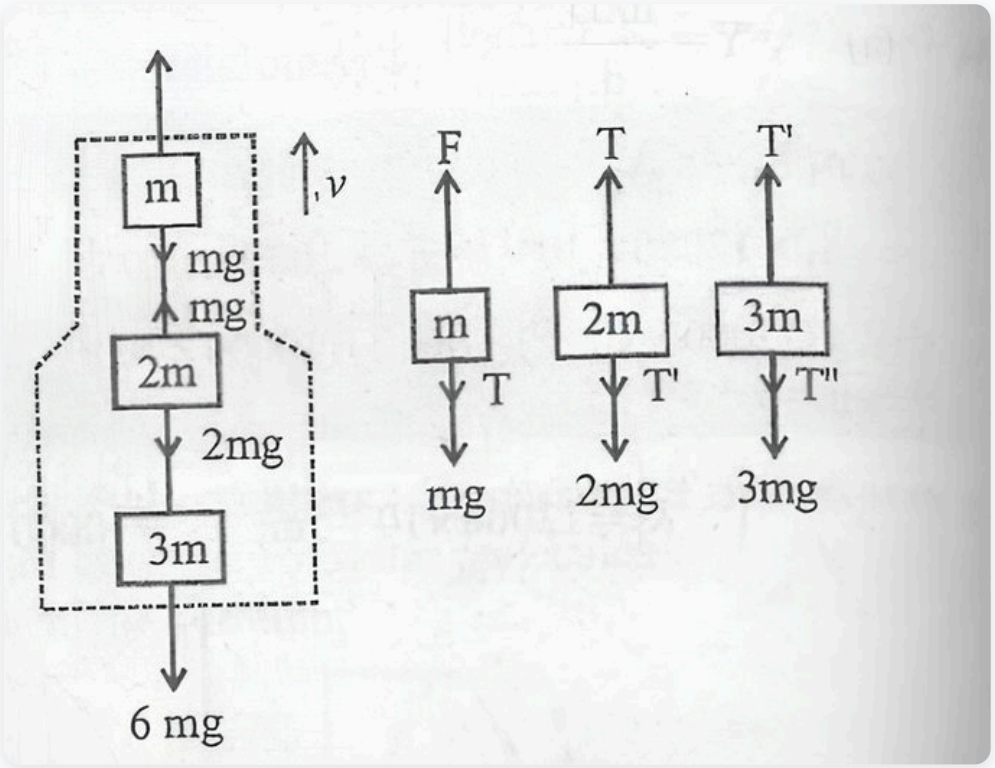
∴ 6 mg = 6ma = 0, F = 6 mg

∴ T = 5 mg , T' = 3 mg

T'' = 0

F_net on block of mass 2 m

= T - T' - 2 mg = 0



Question 45.

The internal resistance of a 2.1 V cell which gives a current of 0.2 A through a resistance of 10 Ω is

[4 Marks]

(A) 0.8 Ω

(B) 0.5 Ω

(C) 1.0 Ω

(D) 0.2 Ω

Explanation:

Given : emf ε = 2.1 V

I = 0.2 A, R = 10Ω

Internal resistance r = ?

From formula.

$\varepsilon - Ir = V = IR$

$2.1 - 0.2r = 0.2 \times 10$

$2.1 - 0.2r = 2$ or $0.2r = 0.1$

$\Rightarrow r = 0.1 / 0.2 = 0.5\Omega$

Question 46.

6.02×10^{20} molecules of urea are present in 100 mL of its solution. The concentration of solution is :

[4 Marks]

(A) 0.01 M

(B) 0.001 M

(C) 0.1 M

(D) 0.02 M

Explanation:

$M = (6.02 \times 10^{20} \times 1000) / (100 \times 6.02 \times 10^{23}) = (6.02 \times 10^{23}) / (6.02 \times 10^{21})$

$= 0.01$ M

Question 47.

The value of Planck's constant is 6.63×10^{-34} Js. The speed of light is 3×10^{-17} nm s^{-1}. Which value is closest to the wavelength in nanometer of a quantum of light with frequency of 6×10^{15} s^{-1}?

[4 Marks]

(A) 25

(B) 50

(C) 10

(D) 75

Explanation:

$c = \upsilon\lambda$

$\lambda = c / \upsilon = (3 \times 10^{17}) / (6 \times 10^{15}) = 50$ nm

Question 48.

Based on equation $E = -2.178 \times 10^{-18} (Z^2 / n^2)$ J, certain conclusions are written. Which of them is not correct ?

[4 Marks]

(A) The negative sign in equation simply means that the energy orelectron bound to the nucleus is lower than it would be if the electrons were at the infinite distance from the nucleus.

(B) For n = 1, the electron has a more negative energy than it does for n = 6 which mean that the electron is more loosely bound in the smallest allowed orbit.

(C) Equation can be used to calculate the change in energy when the electron changes orbit

(D) Larger the value of n, the larger is the orbit radius.

Explanation:

The electrons has more negative energy in lower that in higher orbit and also the electrons are more: bound in the smallest allowed orbit.

Question 49.

What is the maximum numbers of electrons that can be associated with the following set of quantum numbers?
n = 3, l = 1 and m = -1

[4 Marks]

(A) 2

(B) 10

(C) 6

(D) 4

Explanation:

n = 3 → 3rd shell
l = 1 → p sub shell.
m = -1 is possible for two electrons present in an orbital.

Question 50.

Which of the following is electron - deficient?

[4 Marks]

(A) $(CH_3)_2$

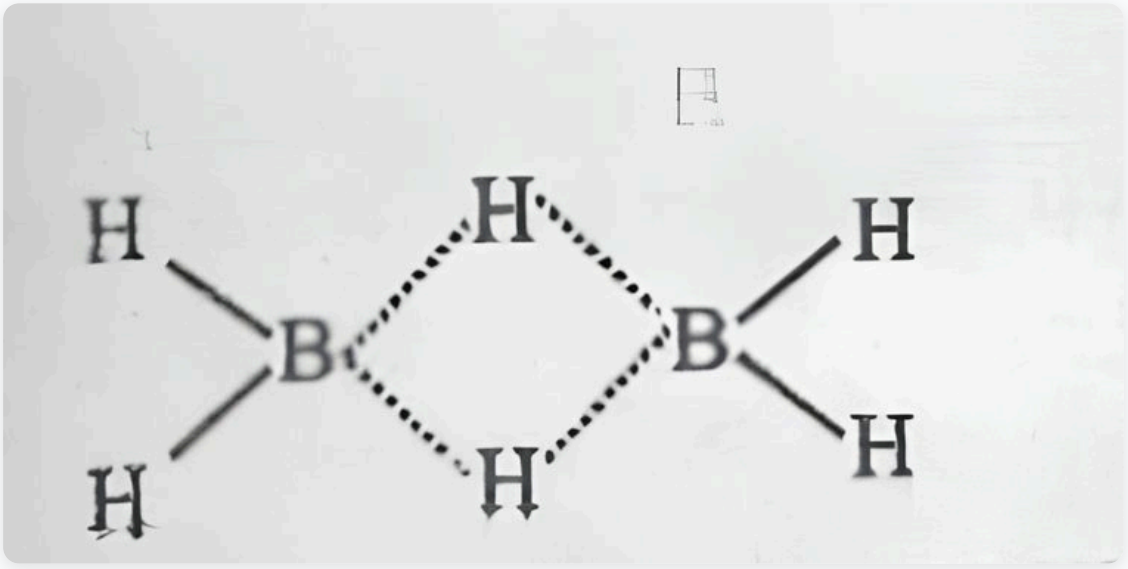
(B) $(BH_3)_2$

(C) $(SiH_3)_2$

(D) PH_3

Explanation:

$(BH_3)_2$ or (B_2H_6)
It contains two, 3 centre - 2 electron bonds that are present above and below the plane of molecules.
Compounds which do not have sufficient number of electrons to form normal covalent bonds are called electron deficient molecules.



Question 51.

Which of the following is a polar molecule?

[4 Marks]

(A) BF_3

(B) XeF_4

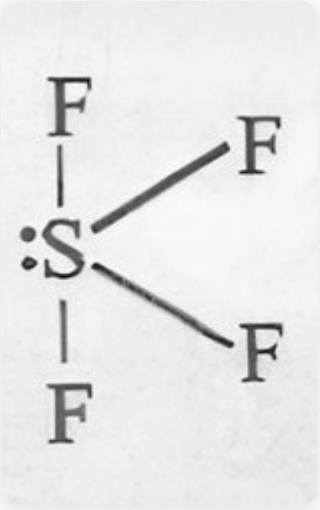
(C) SiF_4

(D) SF_4

Explanation:

SF_4 has 4 bond pairs and 1 lone pair of electrons,
sp^3d hybridisation leads to irregular shape and

resultant μ ≠ 0.



Question 52.

XeF_2 is isostructural with

[4 Marks]

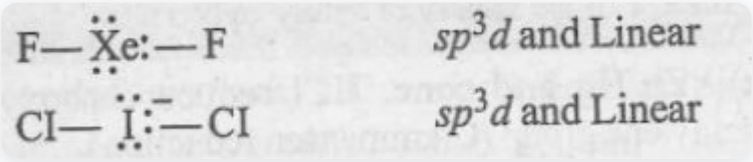
(A) $BaCl_2$

(B) $SbCl_3$

(C) $BaCl_2$

(D) ICl_2^-

Explanation:



Question 53.

Which of the following is paramagnetic?

[4 Marks]

(A) CO

(B) O_2^-

(C) CN^-

(D) NO^+

Explanation:

Molecular orbital configuration of O_2^- is
O_2^- (17) = $\sigma 1s^2$, $\sigma^* 1s^2$, $\sigma 2s^2$, $\sigma^* 2s^2$,
$\sigma 2p_z^2$, $\pi 2p_x^2 = \pi 2p_y^2$, $\pi^* 2p_x^2 = \pi^* 2p_y^1$

Question 54.

Which one of the following molecules contains no pi bond?

[4 Marks]

(A) H_2O

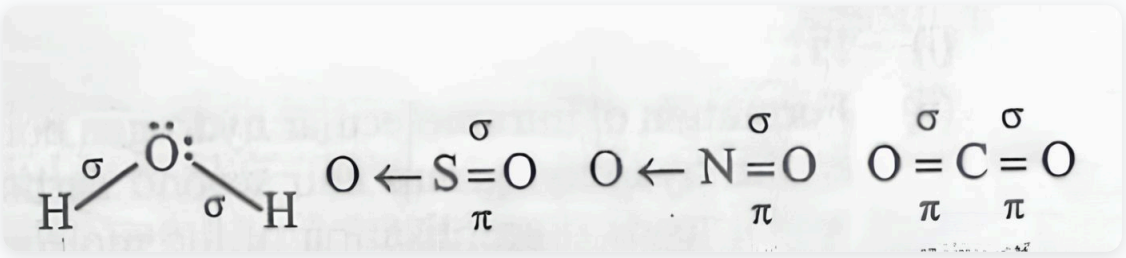
(B) SO_2

(C) CO_2

(D) NO_2

Explanation:

Molecular orbital configuration of O_2^- is
O_2^- (17) = $\sigma 1s^2$, $\sigma^* 1s^2$, $\sigma 2s^2$, $\sigma^* 2s^2$,
$\sigma 2p_z^2$, $\pi 2p_x^2 = \pi 2p_y^2$, $\pi^* 2p_x^2 = \pi^* 2p_y^1$



Question 55.

Dipole-induced dipole interactions are present in which of the following pairs:

[4 Marks]

(A) H_2O and alcohol

(B) $Cl_2$and CCl_4

(C) SiF_4 and He atoms

(D) HCl and He atoms

Explanation:

HCl is polar ($\mu \neq 0$) and He is non-polar ($\mu = 0$), thus gives dipole-induced dipole interaction.

Question 56.

Maximum deviation from ideal gas is expected from:

[4 Marks]

(A) $CH_2(g)$

(B) $N_2(g)$

(C) $NH_2(g)$

(D) $H_2(g)$

Explanation:

Higher the critical temperature more easily will be the gas liquify. Now since most easily liquefiable gas show larger deviation, NH_3 will show maximum deviation from ideal behaviour.

Question 57.

Which of these is least likely to act as Lewis base?

[4 Marks]

(A) F^-

(B) BF_3

(C) PF_3

(D) CO

Explanation:

BF3 acts as Lewis acid

Question 58.

Identify the correct order of solubility in aqueous medium:

[4 Marks]

(A) ZnS > Na_2S > CuS

(B) Na_2S > CuS > ZnS

(C) CuS > ZnS > Na_2S

(D) Na_2S > ZnS > CuS

Explanation:

Solubility of alkali metal is maximum among the following. Among ZnS (1.7×10^{-5}) & CuS (8×10^{-37}) ZnS has higher value of Ksp.

Question 59.

Which of the following structure is similar to graphite?

[4 Marks]

(A) B_2H_6

(B) B_4C

(C) BN

(D) B

Explanation:

Boron nitride (BN) is known as inorganic graphite. The most stable form is hexagonal one. It has layered structure similar to graphite.

Question 60.

Which of these is not a monomer for a high molecular mass silicone polymer?

[4 Marks]

(A) $PhSiCl_3$

(B) $MeSiCl_3$

(C) Me_3SiCl

(D) Me_2SiCl_2

Explanation:

Since Me_3SiCl contains only one Cl, therefore it can't form high molecular mass silicon polymer. It can form only dimer.

Question 61.

The basic structural unit of silicates is:

[4 Marks]

(A) SiO_4^{4-}

(B) SiO_3^{2-}

(C) SiO_4^{2-}

(D) SiO

Explanation:

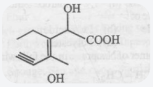
SiO4^4- is basic structural unit of silicates

Question 62.

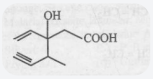
Structure of the compound whose IUPAC name is 3-ethyl-2-hydroxy-4-methylhex-3-en-5-ynoic acid is:

[4 Marks]

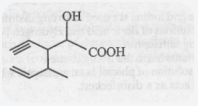
(A)



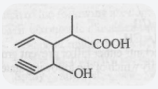
(B)



(C)

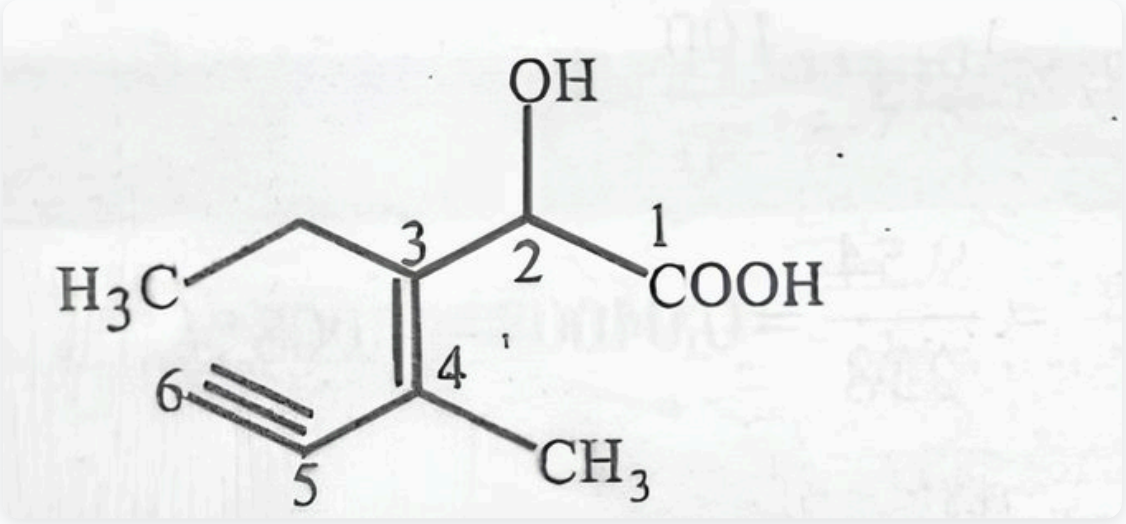


(D)



Explanation:

IUPAC name of the structure is 3-ethyl-2-hydroxy-4-methylhex-3-en-5-ynoic acid

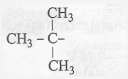


Question 63.

The structure of isobutyl group in an organic compound is:

[4 Marks]

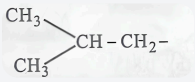
(A)



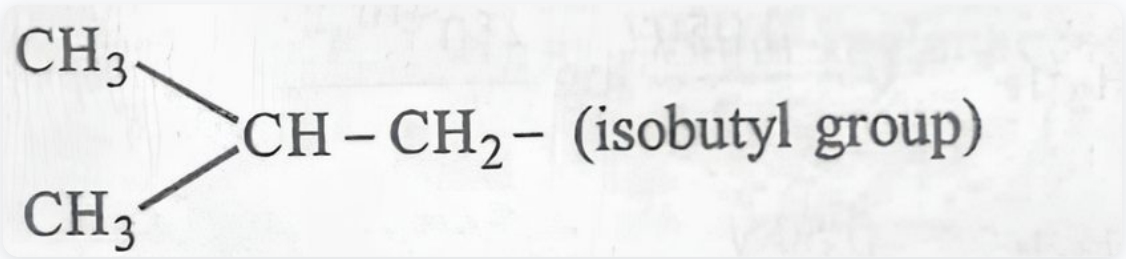
(B) CH_3-CH-CH_3-CH_3

(C) CH_3-CH_2-CH_2-CH_2-

(D)



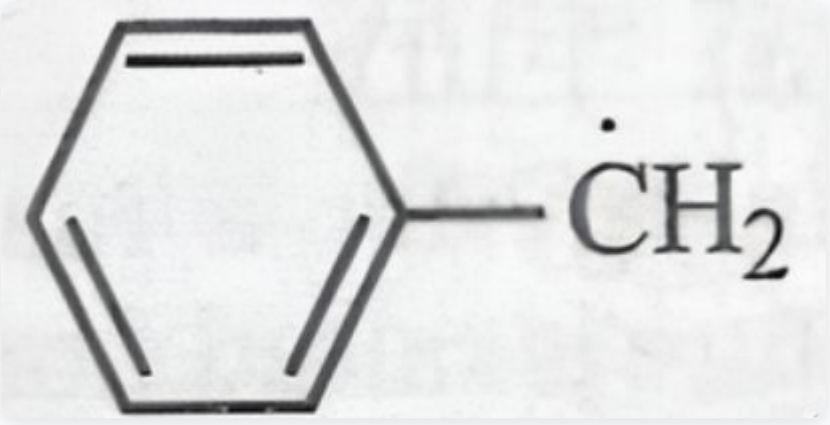
Explanation:



Question 64.

The radical, is aromatic because it has:

[4 Marks]



(A) 6 p-orbitals and 6 unpaired electrons

(B) 6 p-orbitals and 7 unpaired electrons

(C) 7 p-orbitals and 7 unpaired electrons

(D) 7 p-orbitals and 6 unpaired electrons

Explanation:

Presence of 6 p orbitals, each containing one unpaired electron, in a six membered cyclic structure is in accordance with Huckel rule of aromaticity.

Question 65.

Some meta-directing substituents in aromatic substitution are given. Which one is most deactivating?

[4 Marks]

(A) $-SO_3H$

(B) $-C\equiv N$

(C) -COOH

(D) $-NO_2$

Explanation:

Decreasing order of deactivating effect of the given m-directing group is

NO_2 > -CN > $-SO_3H$ > -COOH

—NO_2 group is most deactivating group due to strong — E, —I and —M effects.

Question 66.

Which of the following compounds will not undergo Friedel-Craft's reaction easily:

[4 Marks]

(A) Xylene

(B) Nitrobenzene

(C) Cumene

(D) Toluene

Explanation:

—NO_2 is a powerful electron withdrawing group. Its presence on ring makes the ring less active.

Question 67.

Roasting of sulphides give the gas X as a by product. This is colorless gas with choking smell of burnt sulphur and caused great damage to respiratory organs as a result of acid rain. Its aqueous solution is acidic, acts as a reducing agent and its acid has never been isolated. The gas X is:

[4 Marks]

(A) SO_2

(B) CO_2

(C) H_2S

(D) SO_3

Explanation:

Based on the features given, gas must be SO_2.

Question 68.

Which of the following statements about the interstitial compounds is incorrect?

[4 Marks]

(A) They are chemically reactive.

(B) They are much harder then the pure metal.

(C) They have higher melting points than the pure metal.

(D) They retain metallic conductivity

Explanation:

Interstitial compounds are chemically inert.

Question 69.

The number of carbon atoms per unit cell of diamond unit cell is:

[4 Marks]

(A) 8

(B) 6

(C) 1

(D) 4

Explanation:

Diamond is like ZnS. In diamond cubic unit cell, there are eight corner atoms, six face centered atoms and four more atoms inside the structure (tetrahedral voids).
Total no. of atoms present per unit cell
= 8 x 1/8 + 6 x 1/2 + 4 = 8
(corners) (face centered) (inside body)

Question 70.

A metal has an fcc lattice. The edge length of the unit cell is 404 pm. The density of the metal is 2.72 g cm^{-3}. The molar mass of the metal is: (Na, Avogadro's constant = $6.02 * 10^{23}$ mol^{-1})

[4 Marks]

(A) 40 g mol^{-1}

(B) 20 g mol^{-1}

(C) 27 g mol^{-1}

(D) 30 g mol^{-1}

Explanation:

Density is given by $d=Z \times M/ N_A a^3$
where Z = number of formula units present in

unit cell, which is 4 for fcc
a = edge length of unit cell. M = Molecular mass

$2.72 = 4 \times M / 6.02 \times 10^{23} \times (404 \times 10^{-10})^3$

(∵ 1pm = 10^{-10} cm)

$2.72 \times 6.02 \times (404)^3 / 4 \times 10^7 = 26.99 = 27$ gmol $^{-1}$

Question 71.

How many grams of concentrated nitric acid solution should be used to prepare 250 mL of 2.0M HNO_3 ? The concentrated
acid is 70% HNO_3

[4 Marks]

(A) 45.0 g conc. HNO_3

(B) 90.0 g conc. HNO_3

(C) 70.0 g conc. HNO_3

(D) 54.0 g conc. HNO_3

Explanation:

Molarity (M) = (wt x 1000) / (mol. wt. x vol (mL))

2 = (wt. / 63) x (1000 / 250)

wt. = 63 / 2 g

wt. of 70% acid = 100/70 × 31.5 = 45 g

Question 72.

At 25°C molar conductance of 0.1 molar aqueous solution of ammonium hydroxide is 9.54 ohm^{-1} cm^{2}mol^{-1} and at
infinite dilution its molar conductance is 238 ohm^{-1} cm^2 mol^{-1} . The degree or ionisation of ammonium hydroxide at
the same concentration and temperature is

[4 Marks]

(A) 40.800%

(B) 2.080%

(C) 4.008%

(D) 20.800%

Explanation:

$\alpha = \Lambda m / \Lambda_m\infty$ = 9.54 / 238 = 0.04008 = 4.008%

Question 73.

A hydrogen gas electrode is made by dipping platinum wire in a solution of HCl of pH = 10 and by passing hydrogen gas around the platinum wire at one atm pressure. The oxidation potential of electrode would be ?

[4 Marks]

(A) 0.59V

(B) 0.118V

(C) 1.18V

(D) 0.059V

Explanation:

$H_2 \rightarrow 2H+ + 2e^-$
1 atm 10^{-10}
E_(H2/H+) = 0 - (0.059 / 2) log((10^{-10})² / 1)
E_(H_2/H+) = +0.59 V

Question 74.

A button cell used in watches functions as following:
$Zn(s) + Ag_2O(s) + H_2O(l) \rightleftarrows 2Ag(s) + Zn^{2+}(aq) + 2OH^-(aq)$

If half cell potentials are:
$Zn^{2+}(aq) + 2e^- \rightarrow Zn(s)$; E° = -0.76 V
$Ag2O(s) + H_2O(l) + 2e^- \rightarrow 2Ag(s) + 2OH^-(aq)$; E° = 0.34 V

The cell potential will be:

[4 Marks]

(A) 0.84 V

(B) 0.42 V

(C) 1.34 V

(D) 1.10 V

Explanation:

$E°_{Cell} = E°_{OP} + E°_{RP} = 0.76 + 0.34 = 1.10$ V

Question 75.

What is the activation energy for a reaction if its rate doubles when the temperature is raised from 20°C to 35°C?

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

[4 Marks]

(A) 15.1 kJ mol^{-1}

(B) 342 kJ mol^{-1}

(C) 269 kJ mol^{-1}

(D) 34.7 kJ mol^{-1}

Explanation:

$\log k_2/k_1 = Ea/2.303R\ (1/T_1 - 1/T_2)$

$\log 2 = E_a / (2.303 \times 8.314)\ [1/293 - 1/308]$

$0.3 = E_a / (2.303 \times 8.314) \times 15 / (293 \times 308)$

$E_a = (0.3 \times 2.303 \times 8.314 \times 293 \times 308) / 15$

$= 34673$ J mol^{-1} $= 34.7$ kJ mol^{-1}

Question 76.

A reaction having equal energies of activation for forward and reverse reaction has:

[4 Marks]

(A) $\Delta S = 0$

(B) $\Delta H = \Delta G = \Delta S = 0$

(C) $\Delta H = 0$

(D) $\Delta G = 0$

Explanation:

$\Delta H = E_{af} - E_{ab} = 0$

Question 77.

Which of the following does not give oxygen on heating?

[4 Marks]

(A) $(NH_4)2Cr_2O_7$

(B) $KClO_3$

(C) $Zn(ClO_3)_2$

(D) $K_3Cr_3O_7$

Explanation:

$(NH_4)_2Cr_2O_7 \xrightarrow{\Delta} N_2 + Cr_2O_3 + 4H_2O$

$Zn(ClO_3)_2 \xrightarrow{\Delta} ZnCl_2 + 3O_2$

$2\ KClO_3 \xrightarrow{\Delta} 2KCl + 3O_2$

$4K_2Cr_2O_7 \xrightarrow{\Delta} 4K_2CrO_4 + 2Cr_2O_3 + 3O_2$

Question 78.

Which is the strongest acid in the following:

[4 Marks]

(A) H_2SO_4

(B) $H2SO_3$

(C) $HClO_4$

(D) $HClO_3$

Explanation:

$HClO_4$ is the strongest acid amongst all because the oxidation state of Cl is maximum (+7).

Question 79.

Which of the following lanthanoid ions is diamagnetic?
(At. nos. Ce = 58, Sm = 62, Eu = 63, Yb = 70)

[4 Marks]

(A) Yb^{2+}

(B) Eu^{2+}

(C) Ce^{2+}

(D) Sm^{2+}

Explanation:

Sm^{2+}(Z=62) $[Xe]4f^6 6s^2$- 6 unpaired e^-
Eu^{2+}(Z=63) $[Xe]4f^7 6s^2$ - 7 unpaired e-
Yb^{2+}(Z=70) $[Xe]4f^{14}$ $6s^2$- 0 unpaired e-
Ce^{2+}(Z=58) $[Xe]4f^1$ $5d^1$ $6s^2$ - 2 unpaired e-
Only Yb^{2+} is diamagnetic.

Question 80.

$KMnO_4$ can be prepared from K_2MnO_4 as per the reaction:
$3MnO_4^{2-} + 2H_2O <=> 2MnO_4^- + MnO_2 + 4OH^-$

The reaction can go to completion by removing OH^- ions by adding:

[4 Marks]

(A) KOH

(B) CO_2

(C) HCl

(D) SO_2

Explanation:

HCl and SO_2 are reducing agents and can reduce MnO_4^-. CO_2 which is neither oxidising and nor reducing will provide only acidic medium. It can shift reaction in forward direction and reaction can go to completion

Question 81.

An excess of $AgNO_3$ is added to 100 mL of a 0.01 M solution of dichlorotetraaquachromium (III) chloride. The number of moles of AgCl precipitated would be:

[4 Marks]

(A) 0.001

(B) 0.01

(C) 0.003

(D) 0.002

Explanation:

$[Cr(H_2O)_4Cl_2]Cl + AgNO_3 \rightarrow AgCl + [Cr(H_2O)_4Cl_2]NO_3$

Molarity = wt / mol. mass x 1000 / vol.

wt / mol. mass = molarity x vol. / 1000 = 0.01 x 100 / 1000
= 0.001

Question 82.

A magnetic moment of 1.73 BM will be shown by one among the following:

[4 Marks]

(A) [Ni(CN)_4]^2-

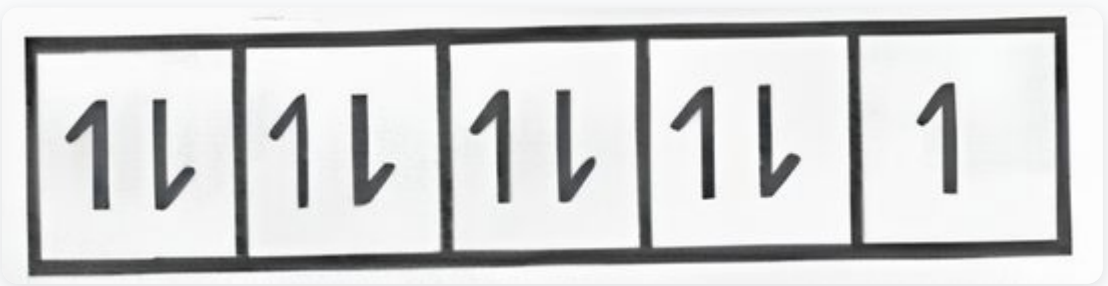
(B) [CoCl_6]^4-

(C) [TiCl_4]

(D) [Cu(NH_3)4]^2+

Explanation:

$[Cu(NH_3)4]^{2+}$ hybridisation dsp^2
Cu^{+2} - $3d^9$has one unpaired e-
So, magnetic moment
$\mu = \sqrt{n(n+2)} = \sqrt{1(1+2)}$
$= \sqrt{3} = 1.73$

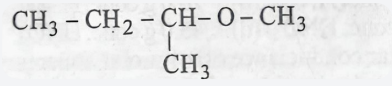


Question 83.

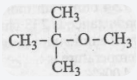
Among the following ethers, which one will produce methyl alcohol on treatment with hot concentrated HI?

[4 Marks]

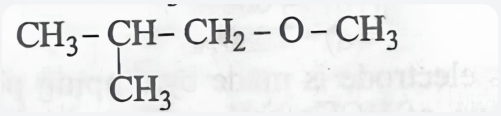
(A)



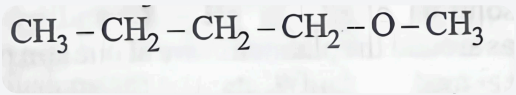
(B)



(C)

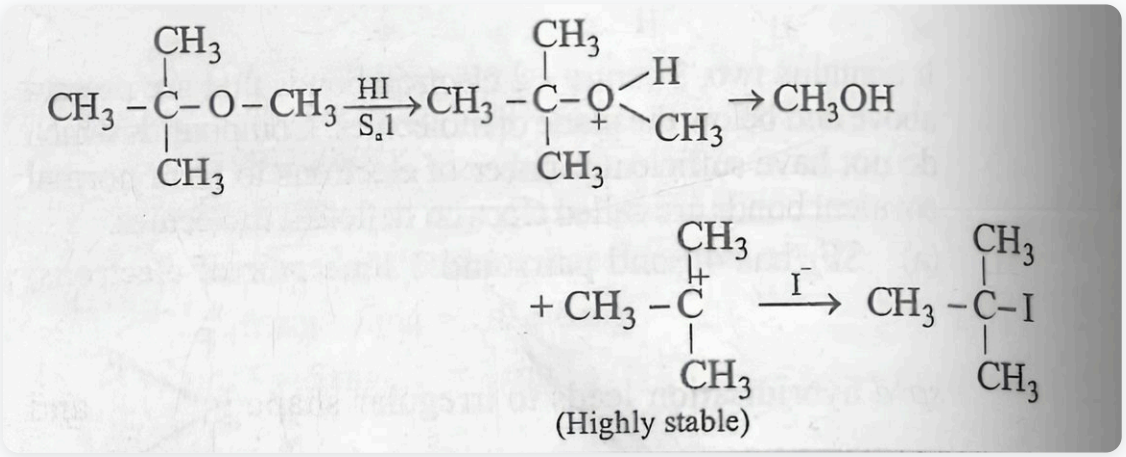


(D)



Explanation:

The reaction will proceed via S_N1 mechanism because alkyl group attached is 3°.

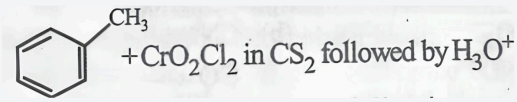


Question 84.

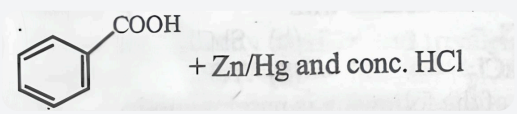
Reaction by which Benzaldehyde cannot be prepared:

[4 Marks]

(A)



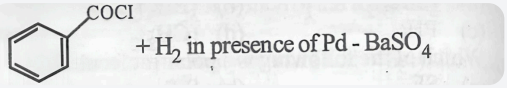
(B)



(C)



(D)



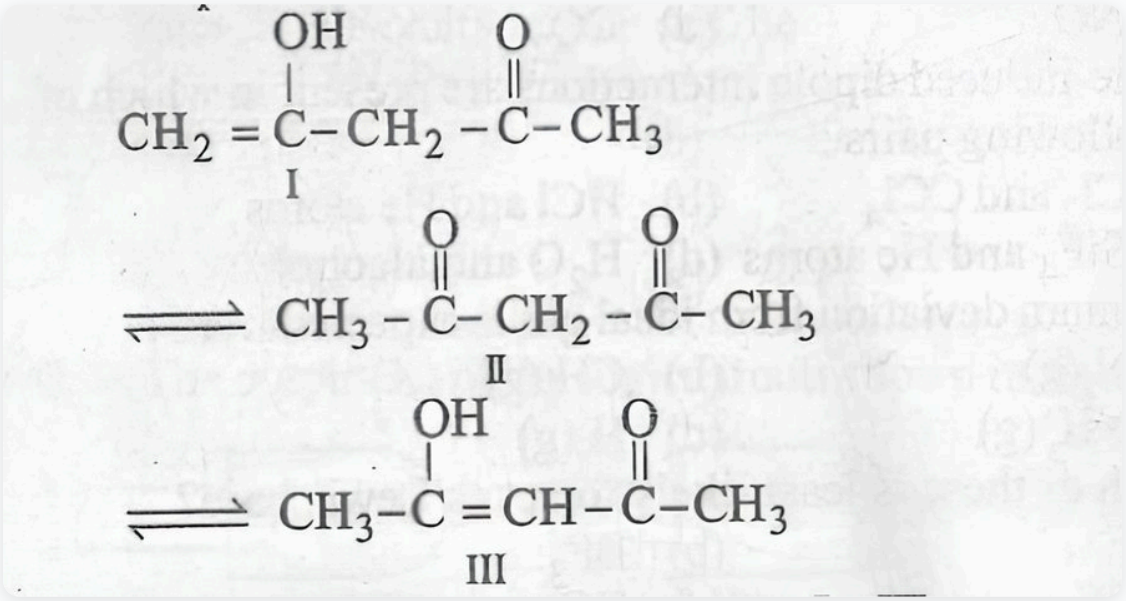
Explanation:

Zn/Hg and conc. HCl reduce carboxyl group to methylene group (Clemmensen reduction).

Question 85.

The order of stability of the following tautomeric compounds is:

[4 Marks]



(A) III > II > I

(B) II > I > III

(C) II > III > I

(D) I > II > III

Explanation:

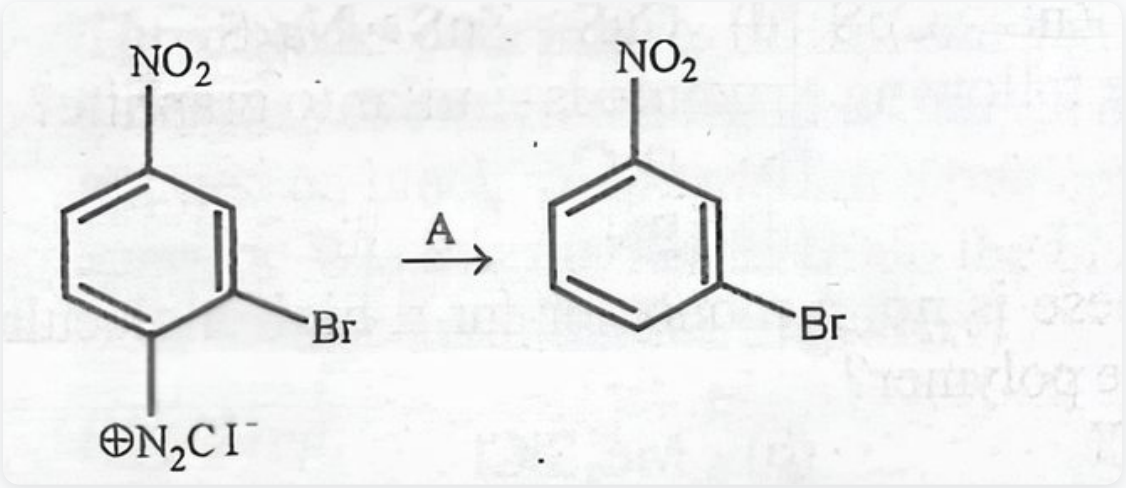
Enolic form predominates in compounds containing two carbonyl groups separated by a $-CH_2$ group. This is due to following two factors.
(i) Presence of conjugation which increases stability.
(ii) Formation of intramolecular hydrogen bond between enolic hydroxyl group and second carbonyl group which leads to stabilisation of the molecule. Hence, the correct answer is III > II > I.

Question 86.

In the reaction

A is:

[4 Marks]



(A) Cu_2Cl_2

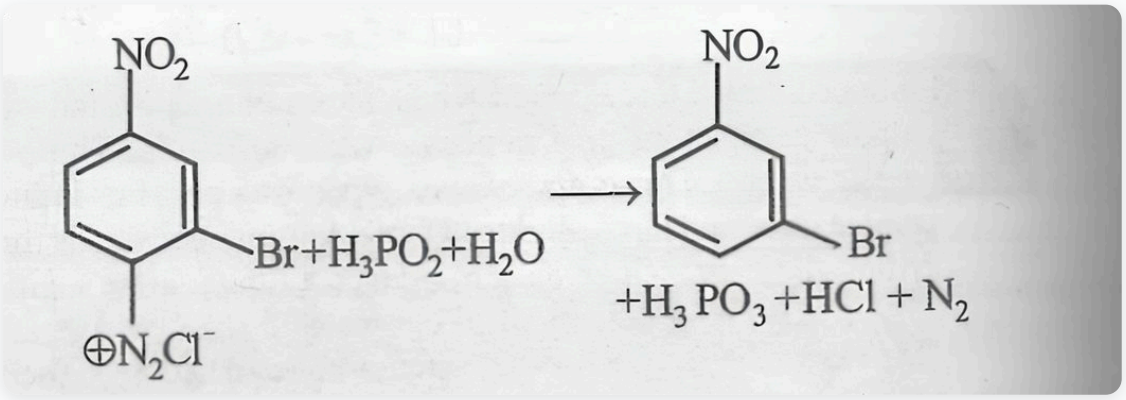
(B) $H_3PO_2$and H_2O

(C) H+ / H_2O

(D) $HgSO_4$ / $H2SO_4$

Explanation:

Enolic form predominates in compounds containing two carbonyl groups separated by a -CH_2 group. This is due to following two factors.
(i) Presence of conjugation which increases stability.
(ii) Formation of intramolecular hydrogen bond between enolic hydroxyl group and second carbonyl group which leads to stabilisation of the molecule. Hence, the correct answer is III > II > I.



Question 87.

Nitrobenzene on reaction with conc. HNO_3 / H_2SO_4 at 80-100°C forms which one of the following products?

[4 Marks]

(A) 1,3-Dinitrobenzene

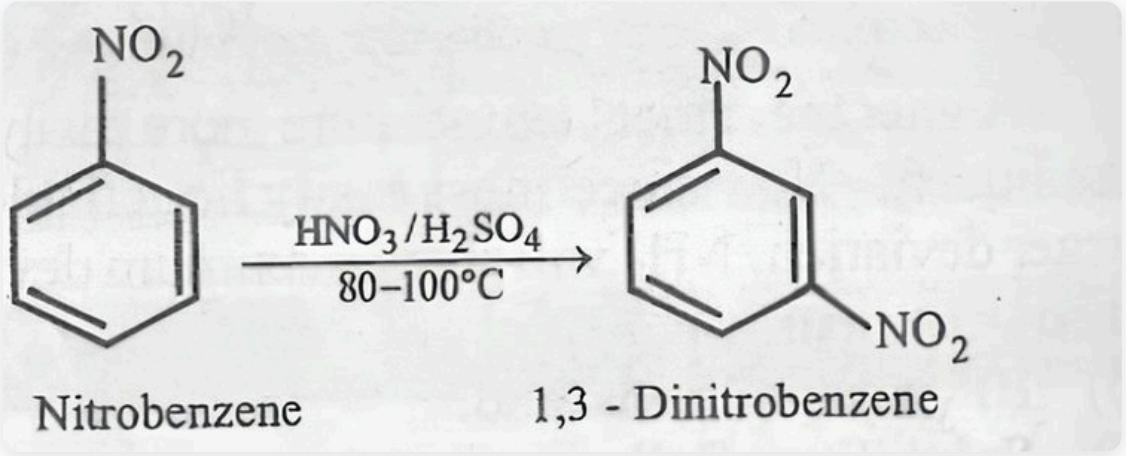
(B) 1,4-Dinitrobenzene

(C) 1,2,4-Trinitrobenzene

(D) 1,2-Dinitrobenzene

Explanation:

Enolic form predominates in compounds containing two carbonyl groups separated by a $-CH_2$ group. This is due to following two factors.
(i) Presence of conjugation which increases stability.
(ii) Formation of intramolecular hydrogen bond between enolic hydroxyl group and second carbonyl group which leads to stabilisation of the molecule. Hence, the correct answer is III > II > I.



Question 88.

Nylon is an example of:

[4 Marks]

(A) Polythene

(B) Polyamide

(C) Polysaccharide

(D) Polyester

Explanation:

Nylon is a synthetic polyamide polymer.

Question 89.

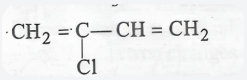
Which is the monomer of Neoprene in the following?

[4 Marks]

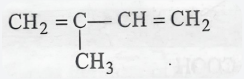
(A) $CH_2 = CH - CH = CH_2$

(B) $CH_2 = CH - C \equiv CH$

(C)

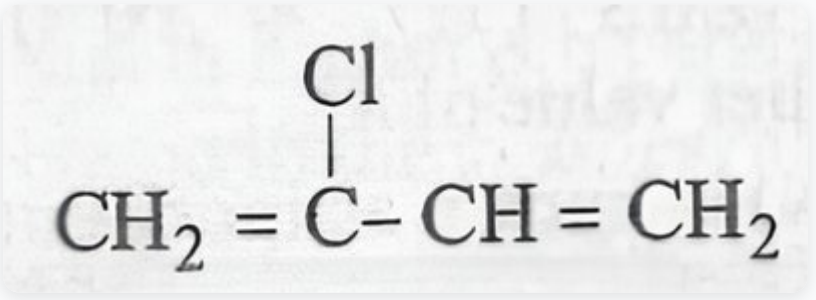


(D)



Explanation:

(chloroprene) is the monomer of neoprene



Question 90.

Antiseptics and disinfectants either kill or prevent growth of microorganisms. Identify which of the following statements is not true

[4 Marks]

(A) Chlorine and iodine are used as strong disinfectants.

(B) Dilute solutions of Boric acid and Hydrogen Peroxide are strong antiseptics.

(C) Disinfectants harm the living tissues.

(D) A 0.2% solution of phenol is an antiseptic while 1% solution acts as a disinfectant.

Explanation:

Dilute solutions of boric acid and hydrogen peroxide are weak antiseptics.

Question 91.

Which one of the following is not a correct statement?

[4 Marks]

(A) Botanical gardens have collection of living plants for reference

(B) A museum has collection of photographs of plants and animals

(C) Key is taxonomic aid for identification of specimens.

(D) Herbarium houses dried, pressed and preserved plant specimens.

Explanation:

Museums- are generally set up in educational institutes such as schools and colleges. Museums have collections of preserved plant and animal specimens for study and reference.

Question 92.

Which of the following are likely to be present in deep sea water?

[4 Marks]

(A) Blue-green algae

(B) Eubacteria

(C) Archaebacteria

(D) Saprophytic fungi

Explanation:

Archaebacteria live in some of the most harsh habitats such as extreme salty area (halophiles), hot springs (thermoacidophiles) and marshy areas (methanogens) and in deep sea water.

Question 93.

Isogamous condition with non-flagellated gametes is found in

[4 Marks]

(A) Fucus

(B) Chlamydomonas

(C) Volvox

(D) Spirogyra

Explanation:

In Spirogyra, sexual reproduction occurs through conjugation. Gametes are non-flagellated, morphologically similar. But physiologically different (isogamy with physiological anisogamy). Volvox and Fucus are examples of oogamous and Chlamydomonas contains isogamous flagellated gametes.

Question 94.

Which of the following is not correctly matched for the organism and its cell wall degrading enzyme?

[4 Marks]

(A) Algae-Methylase

(B) Plant cells-Cellulase

(C) Fungi-Chitinase

(D) Bacteria-Lysozyme

Explanation:

Algae is a plant and so its cell wall is made up of cellulose. Cellulase enzyme is needed for degradation of its cell wall.

Question 95.

Besides paddy fields cyanobacteria are also found inside vegetative part of

[4 Marks]

(A) Cycas

(B) Equisetum

(C) Pinus

(D) Psilotum

Explanation:

In Cycas specialised root called coralloid roots are associated with N_2- fixing cyanobacteria either Nostoc or Anabaena. Coralloid roots lie near the soil surface. They are irregular and often dichotomously branched. Root hair and root cap are absent in these roots.

Question 96.

Read the following statements (A-E) and answer the question which follows them.

A. In liverworts, mosses and ferns gametophytes are free-living

B. Gymnosperms and some ferns are heterosporous.

C. Sexual reproduction in Fucus, Volvox and Albugo is oogamous

D. The sporophyte in liverworts is more elaborate than that in mosses

E. Both, Pinus and Marchantia are dioecious

How many of the above statements are correct?

[4 Marks]

(A) Four

(B) One

(C) Three

(D) Two

Explanation:

Statement (A), (B) and (C) are correct. In liverworts and ferns gametophytes are free living while in fern, sporophytes are free living. Gymnosperms and genera like Selaginella and Salvinia are heterosporous. The sporophyte in mosses are more elaborate than that of liverworts, Pinus is monoecious and heterosporous. Marchantia is dioecious.

Question 97.

Which group of animals belong to the same phylum?

[4 Marks]

(A) Earthworm, Pinworm, Tapeworm

(B) Prawn, Scorpion, Locusta

(C) Sponge, Sea anemone, Starfish

(D) Malarial parasite, Amoeba, Mosquito

Explanation:

Prawn , Scorpion and Locusta belong to phylum Arthropoda. This is the largest phylum of Animalia, over two-thirds of all named species on earth are Arthropoda. Phylum is named so due to presence of jointed appendages (arthros - jointed, poda - appendages) in body of members of this phylum.

Question 98.

One of the representatives of phylum Arthropoda is

[4 Marks]

(A) Silverfish

(B) Pufferfish

(C) Cuttlefish

(D) Flying fish

Explanation:

Representative of Phylum Arthropoda is silverfish. Arthropoda is the largest phylum of Animalia, which covers two-thirds of all named species

Question 99.

Which of the following are correctly matched with respect to their taxonomic classification

[4 Marks]

(A) Centipede, millipede, spider, scorpion-Insecta

(B) House fly, butterfly, tse tse fly, silverfish-Insecta

(C) Flying fish, cuttlefish, silverfish-Pisces

(D) Spiny anteater, sea urchin, sea cucumber-Echinodermata

Explanation:

House fly, butterfly, tse tse fly, silverfish all belongs to insecta

Question 100.

Match the name of the animal (column I), with one characteristics (column II), and the phylum/class (column III) to which it belongs:

[4 Marks]

	Column I	Column II	Column III
(a)	*Ichthyophis*	terrestrial	Reptilia
(b)	*Limulus*	body covered by chitinous exoskeleton	Pisces
(c)	*Adamsia*	radially symmetrical	Porifera
(d)	*Petromyzon*	ectoparasite	Cyclostomata

(A) Option (b)

(B) Option (a)

(C) Option (c)

(D) Option (d)

Explanation:

Ichthyophis - Amphibian
Limulus - Arthropoda
Adamsia - Cnidaria
Petromyzon - Jawless vertebrate & ectoparasite, cyclostomate

Question 101.

Among bitter gourd, mustard, brinjal, pumpkin, china rose, lupin, cucumber, sunhemp, gram, guava, bean, chilli, plum, petunia, tomato, rose, withania, potato, onion, aloe and tulip how many plants have hypogynous flower?

[4 Marks]

(A) Ten

(B) Fifteen

(C) Eighteen

(D) Six

Explanation:

Mustard (cruciferae) , brinjal (solanaceae) china rose (malvaceae), lupin (leguminosae), gram (leguminosae), bean (leguminosae), chilli, Petunia, potato, tomato, Withania (solanaceae), onion,

Aloe, tulip (liliaceae) have hypogynous flower while bittergourd, cucumber (cucurbitaceae), guava (myrtaceae) have epigynous flower and rose has perigynous flower.

Question 102.

In china rose the flowers are:

[4 Marks]

(A) Actinomorphic, epigynous with valvate aestivation

(B) Zygomorphic, epigynous with imbricate aestivation

(C) Zygomorphic, hypogynous with twisted aestivation

(D) Actinomorphic, hypogynous with twisted aestivation

Explanation:

In china rose (Hibiscus rosa-sinensis) flowers are actinomorphic , hypogynous with twisted aestivation in corolla.

Question 103.

Age of a tree can be estimated by:

[4 Marks]

(A) number of annual rings

(B) diameter of its heartwood

(C) biomass

(D) its height and girth

Explanation:

Age of a tree can be estimated by number of annual rings. Annual ring constitute alternate concentric rings of spring wood and autumn wood.

Question 104.

Lenticels are involved in:

[4 Marks]

(A) Gaseous exchange

(B) Food transport

(C) Transpiration

(D) Photosynthesis

Explanation:

Lenticels are lens shaped openings occuring in stems of most of the woody trees. It permits the exchange of gases between the outer atmosphere and the internal tissue of the stem.

Question 105.

Interfascicular cambium develops from the cells of:

[4 Marks]

(A) Xylem parenchyma

(B) Endodermis

(C) Pericycle

(D) Medullary rays

Explanation:

At the time of secondary growth interfascicular cambium is formed by parenchymatous medullary rays. Interfascicular cambium along with intrafascicular cambium (formed from cambium cells present between xylem and phloem) constitute continuous cambium ring. If new cells are cut off in both directions it causes secondary growth in most dicotyledonous plants.

Question 106.

What external changes are visible after the last moult of a cockroach nymph?

[4 Marks]

(A) Anal cerci develop

(B) Both fore wings and hind wings develop

(C) Labium develops

(D) Mandibles become harder

Explanation:

The development of cockroach is paurometabolous meaning that their development is through nymphal stage. The nymphs look very much like adults. The nymph grows by moulting about 13 times to reach adult form. The last nymphal stage has wingpads while adult cockroaches have wings.

Question 107.

Which one of the following organelle in the figure correctly matches with its function?

[4 Marks]



(A) Golgi apparatus, protein synthesis

(B) Golgi apparatus, formation of glycolipids

(C) Rough endoplasmic reticulum, protein synthesis

(D) Rough endoplasmic reticulum, formation of glycoproteins

Explanation:

Rough endoplasmic reticulum is a network or reticulum of tiny tubular structures scattered in the cytoplasm and bear ribosomes on their outer surface. These are involved in protein synthesis and secretion. They are extensive and continuous with the outer membrane of the nucleus

Question 108.

The Golgi complex plays a major role :

[4 Marks]

(A) in digesting proteins and carbohydrates

(B) as energy transferring organelles

(C) in post translational modification of proteins and glycosidation of lipids

(D) in trapping the light and transforming it into chemical energy

Explanation:

Golgi apparatus plays a major role in post translational modification of proteins forming glycoprotein and glycosidation of lipid forming glycolipids. A number of proteins and lipids synthesised on endoplasmic reticulum (rough and smooth respectively) are modified in the cisternae of the Golgi apparatus before they are released from the trans face.

Question 109.

A major site for synthesis of lipids is :

[4 Marks]

(A) SER

(B) Symplast

(C) RER

(D) Nucleoplasm

Explanation:

The smooth endoplasmic reticulum is the major site for synthesis of lipid. In animal cells lipid like steroidal hormones are synthesised in SER.

Question 110.

A phosphoglyceride is always made up of :

[4 Marks]

(A) only an unsaturated fatty acid esterified to a glycerol molecule to which a phosphate group is also attached

(B) a saturated or unsaturated fatty acid esterified to a glycerol molecule to which a phosphate group is also attached

(C) a saturated or unsaturated fatty acid esterified to a phosphate group which is also attached to a glycerol molecule

(D) only a saturated fatty acid esterified to a glycerol molecule to which a phosphate group is also attached

Explanation:

A saturated or unsaturated fatty acid esterified to a glycerol molecule to which a phosphate group is also attached forms phosphoglycerides.

Question 111.

The essential chemical components of many coenzymes are :

[4 Marks]

(A) Carbohydrates

(B) Nucleic acids

(C) Vitamins

(D) Proteins

Explanation:

The essential chemical components of many coenzymes are vitamins, e.g., coenzyme nicotinamide adenine dinucleotide (NAD) and NADP contain vitamin niacin

Question 112.

Transition state structure of the substrate formed during an enzymatic reaction is :

[4 Marks]

(A) transient and unstable

(B) permanent and stable

(C) permanent but unstable

(D) transient but stable

Explanation:

Transition state structure formed during an enzymatic reaction is transient and unstable.

Question 113.

Macro molecule chitin is :

[4 Marks]

(A) Phosphorus containing polysaccharide

(B) Sulphur containing polysaccharide

(C) Simple polysaccharide

(D) Nitrogen containing polysaccharide

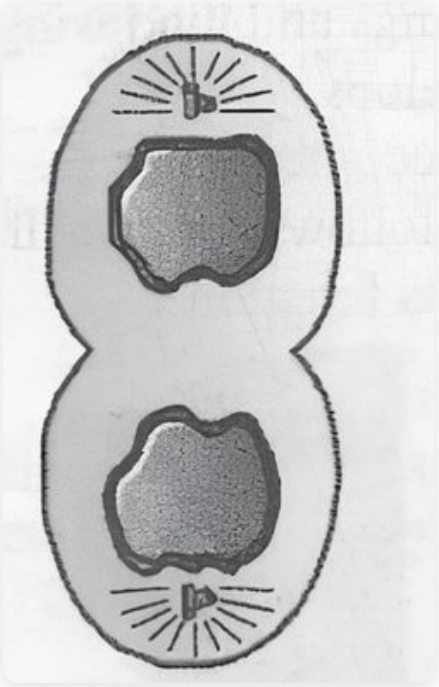
Explanation:

Chitin or fungal cellulose is a nitrogen containing polysaccharide and hetero-polymer of NAG.

Question 114.

A stage in cell division is shown in the figure. Select the answer which gives correct identification of the stage with its characteristics.

[4 Marks]



(A) Cytokinesis: Cell plate formed, mitochondria distributed between two daughter cells

(B) Late anaphase: Chromosomes move away from equatorial plate, Golgi complex not present

(C) Telophase: Endoplasmic reticulum and nucleolus not reformed yet

(D) Telophase: Nuclear envelop reforms, golgi complex reforms

Explanation:

Telophase is the stage of reconstitution of nuclei. The chromosomes that have reached their respective poles decondense and lose their individuality and collect in a mass in the two poles. Nuclear envelope assemble around chromatin mass. Nucleolus, Golgi complex and ER reform.

Question 115.

The complex formed by a pair of synapsed homologous chromosomes is called :

[4 Marks]

(A) Kinetochore

(B) Bivalent

(C) Equatorial plate

(D) Axoneme

Explanation:

During zygotene, second stage of meiosis I, homologous chromosomes start pairing together forming a complex structure called synaptonemal complex. The complex formed by a pair of synapsed homologous chromosome is called a bivalent or a tetrad. Crossing over occurs between non-sister chromatids of bivalent in the next stage.

Question 116.

Which of the following criteria does not pertain to facilitated transport?

[4 Marks]

(A) High selectivity

(B) Transport saturation

(C) Uphill transport

(D) Requirement of special membrane proteins

Explanation:

Substances that have a hydrophilic moiety, find it difficult to pass through the membrane, their movement has to be facilitated by the membrane protein without expenditure of ATP energy. Facilitated Diffusion cannot cause net transport of molecules from a low to a high concentration or uphill transport.

Question 117.

The first stable product of fixation of atmospheric nitrogen in leguminous plants is :

[4 Marks]

(A) Ammonia

(B) NO_2^-

(C) Glutamate

(D) NO_3^-

Explanation:

Ammonia is the first stable compound produced in fixation of atmospheric nitrogen in leguminous plant. A molecule of nitrogen is changed into two molecules of ammonia. It requires 16 ATP, a source of electron donor ferredoxin, hydrogen donor NADPH or FMNH2 and dinitrogenase enzyme

Question 118.

Pigment-containing membranous extensions in some cyanobacteria are :

[4 Marks]

(A) Chromatophores

(B) Heterocysts

(C) Basal bodies

(D) Pneumatophores

Explanation:

In some photosynthetic bacteria, bacteriochlorophyll and bacteriophaeophytin or bacteriorhodopsin pigments containing membranous extensions called chromatophores are present. These are sites of bacterial photosynthesis.

Question 119.

Which of the metabolites is common to respiration-mediated breakdown of fats, carbohydrates and proteins

[4 Marks]

(A) Fructose 1, 6 - bisphosphate

(B) Pyruvic acid

(C) Acetyl CoA

(D) Glucose - 6 - phosphate

Explanation:

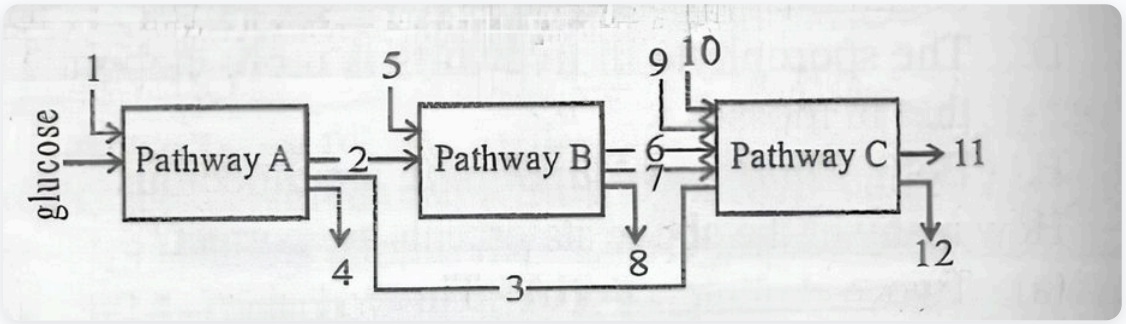
Acetyl CoA is common to respiration mediated breakdown of fats, carbohydrates and proteins. Fats are broken down to fatty acid and glycerol and finally we degraded to acetyl co - A. Protein first degraded by proteases to individual amino acids which are deaminated to pyruvic acid and further decarboxylated to acetyl co-A.

Question 120.

The three boxes in this diagram represent the three major biosynthetic pathways in aerobic respiration. Arrows represent reactants or products.

Arrows numbered 4, 8 and 12 can all be :

[4 Marks]



(A) ATP

(B) H_2O

(C) $FAD^+$to $FADH_2$

(D) NADH

Explanation:

In the given diagram of aerobic respiration - pathway A is glycolysis, pathway B is Kreb's cycle and pathway C is ETS , thus 4, 8 & 12 are ATP. ATP act as energy currency. The energy is trapped in form of ATP and it is broken down whenever and wherever it needs to be utilised.

Question 121.

During seed germination its stored food is mobilized by :

[4 Marks]

(A) Ethylene

(B) Gibberellin

(C) ABA

(D) Cytokinin

Explanation:

Gibberellins stimulate the synthesis of α-amylase and protease enzyme in germinating grains of cereals. They are involved in the conversion of starch into sugar. The proteases convert an inactive β-amylase to the active form. The active β-amylase and α-amylase together digest starch to glucose which is mobilised to meet the metabolic demands of embryo.

Question 122.

Select the correct match of the digested products in humans given in column - I with their absorption site and mechanism in column-II

[4 Marks]

	Column I	Column II
(a)	Fructose, Na^+	Small intestine, passive absorption
(b)	Glycerol, fatty acids	Duodenum, move as chylomicrons
(c)	Cholesterol, maltose	Large intestine, active absorption
(d)	Glycine, glucose	Small intestine, active absorption

(A) Option(b)

(B) Option (a)

(C) Option (d)

(D) Option (c)

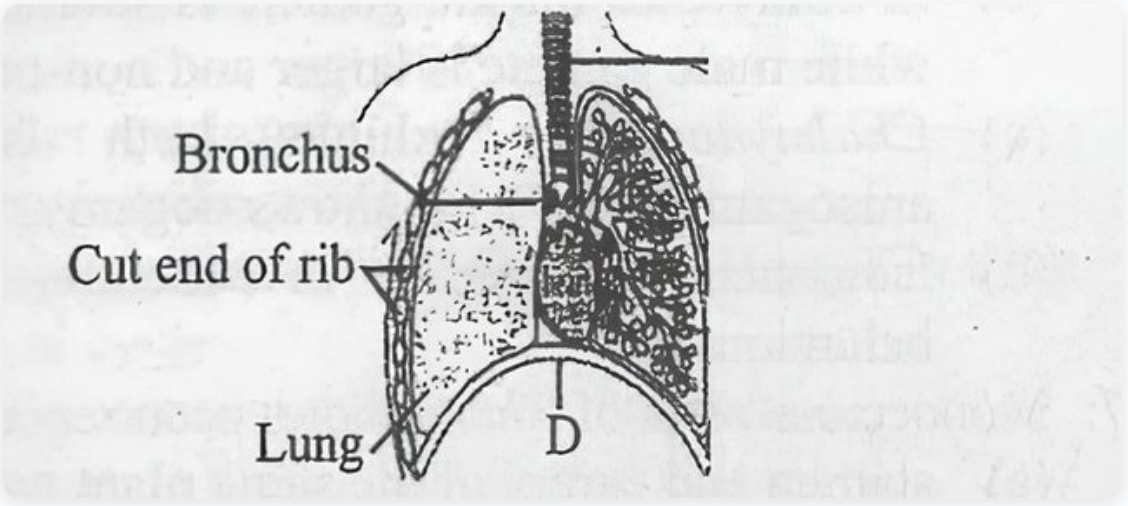
Explanation:

Small intestine is major area of absorbtion of nutrients. Approximately 90% of absorbtion take place here. Glucose, fructose, fatty acids, amino acids (Glycine etc) are absorbed through mucosa into blood and lymph by active absorbtion.

Question 123.

The figure shows a diagrammatic view of human respiratory system with labels A, B, C and D. Select the option which gives correct identification and main function and/or characteristics.

[4 Marks]



(A) B-pleural membrane-surrounds ribs on both sides to provides cushion against rubbing.

(B) C-Alveoli-thin walled vascular bag like structures for exchange of gases.

(C) A-trachea-long tube supported by complete cartilaginous rings for conducting inspired air.

(D) D-Lower end of lungs-diaphragm pulls it down during inspiration

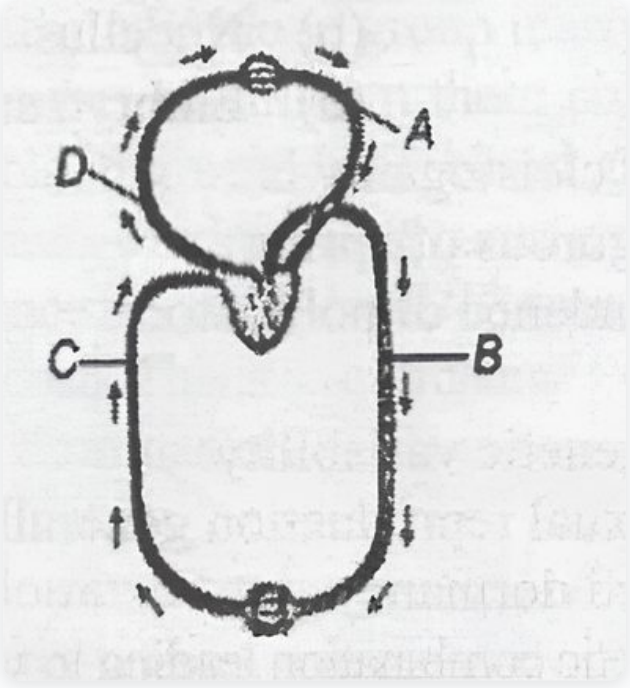
Explanation:

Alveoli are very thin, irregular walled bag like structures for gaseous exchange. Tracheae bronchi and bronchioles are supported by incomplete cartilaginous rings. Double layered pleural membrane surrounds the lungs with pleural fluid between them. It reduces friction on the lung surface.

Question 124.

Figure shows schematic plan of blood circulation in humans with labels A to D. Identify the label and give its function's.

[4 Marks]



(A) B-Pulmonary artery-takes blood from heart to lungs, PO_2 = 90 mm Hg

(B) C-Vena Cava - takes blood from body parts to right auricle, PCO_2 = 45 mm Hg

(C) A-Pulmonary vein - takes impure blood from body parts, PO_2 = 60 mm Hg

(D) D - Dorsal aorta - takes blood from Heart to body Part PO_2 = 95 mm Hg

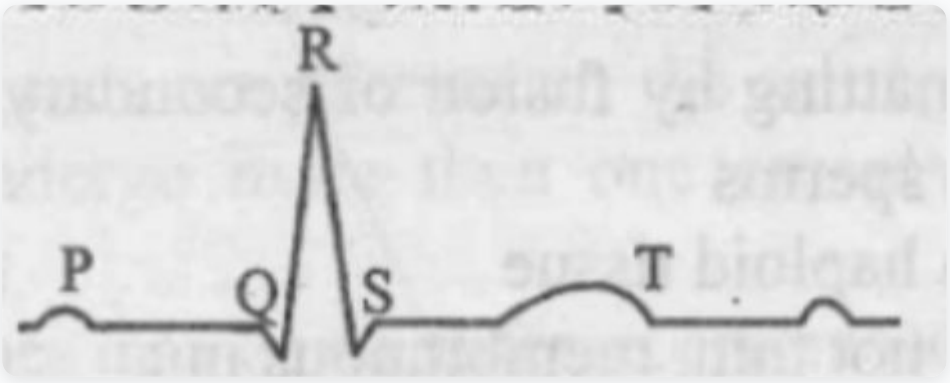
Explanation:

A is pulmonary vein which takes pure blood from lungs to heart. B is dorsal aorta which takes pure blood from heart to various body parts. C is vena cava which takes impure blood from various body parts to right auricle of the heart. D is pulmonary artery which takes impure blood from heart to lungs.

Question 125.

The diagram given here is the standard ECG of a normal person the P-wave represents the

[4 Marks]



(A) Initiation of the ventricular contraction

(B) Beginning of the systole

(C) End of systole

(D) Contraction of both the atria

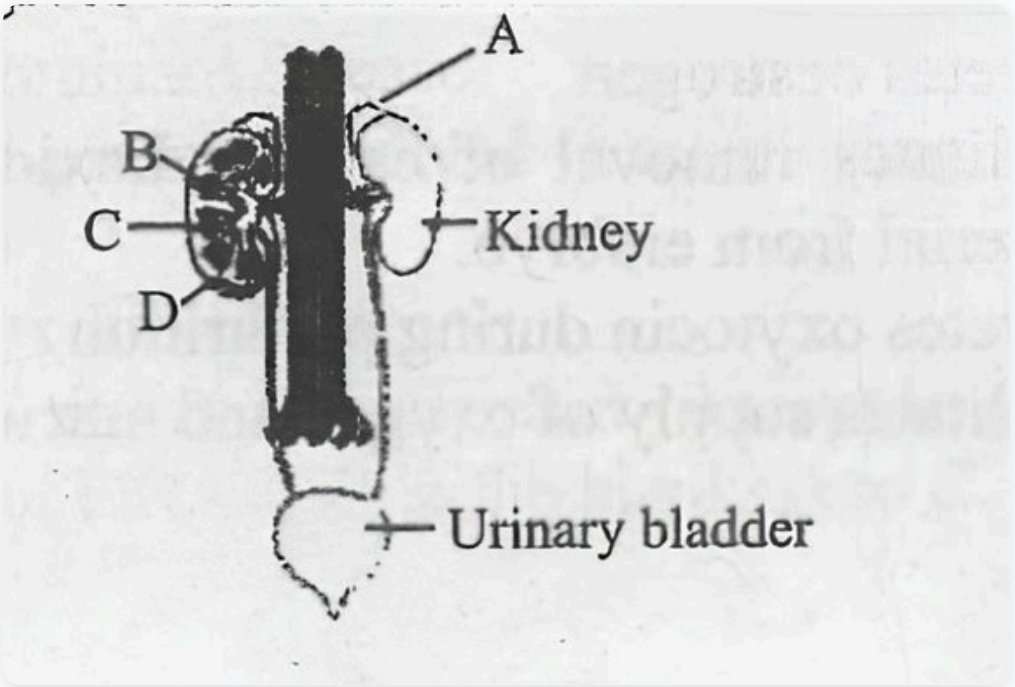
Explanation:

In the given ECG of a normal person, P-wave represents the electrical excitation (or depolarization) of the atria, which leads to the contraction of both the atria. The QRS complex represents the depolarization of the ventricles, which initiates the ventricular contraction. The contraction starts shortly after Q and marks the beginning of the systole.

Question 126.

Figure shown human urinary system with structures labelled A to D. Select option which correctly identifies them and gives their characteristics and/or functions.

[4 Marks]



(A) D - Cortex - outer part of kidney and do not contain any part of nephrons

(B) A-Adrenal gland - located at the anterior part of kidney. Secrete Catecholamines which stimulate glycogen breakdown.

(C) C-Medulla-inner zone of kidney and contains complex nephrons.

(D) B-pelvis-broad funnel shaped space inner to hilum, directly connected to loops of Henle

Explanation:

A - Adrenal gland - located at the anterior part of kidney, secretes Catecholamines which stimulate glycogen breakdown.

Question 127.

The H-zone in the skeletal muscle fibre is due to:

[4 Marks]

(A) The central gap between actin filaments extending through myosin filaments in the A-band

(B) The central gap between myosin filaments in the A-band.

(C) Extension of myosin filaments in the central portion of the A-band.

(D) The absence of myofibrils in the central portion of A-band.

Explanation:

Central part of thick filament, not overlapped by thin filaments is called the 'H' zone. 'H' zone is also called Hensen's Line.

Question 128.

The characteristics and an example of a synovial joint in humans is :
Characteristics | Examples

[4 Marks]

(A) Fluid cartilage between two bones, limited movements | Knee joint

(B) Lymph filled between two bones, limited movement | gliding joint between carpals

(C) Fluid filled synovial cavity between two | Joint between atlas and axis bones

(D) Fluid filled between two joints, provides cushion | Skull bones

Explanation:

Synovial joints are characterized by the presence of a fluid filled synovial cavity between the articulating surfaces of the two bones. Such an arrangement allows considerable movement. These joints help in locomotion and many other movements. Ball and socket joint (between humerus and pectoral girdle), Hinge joint (knee joint), Pivot joint (between atlas and axis), Gliding joint (between the carpals) and Saddle joint (between carpal and metacarpal of thumb) are some examples.

Question 129.

Select the correct statement with respect to locomotion in humans :

[4 Marks]

(A) Accumulation of uric acid crystals in joints causes their inflammation

(B) The vertebral column has 10 thoracic vertebrae

(C) The joint between adjacent vertebrae is a fibrous joint

(D) The decreased level of progesterone causes osteoporosis in old people

Explanation:

Vertebral column has 12 thoracic vertebrae. The joints between adjacent vertebrae is cartilaginous joint which permits limited movements. Progesterone is secreted by corpus luteum which supports in pregnancy in females. Deposition of uric acid in form of urate crystal in the joint are responsible for the inflammation and painful symptoms of gout

Question 130.

The most abundant intracellular cation is :

[4 Marks]

(A) Ca^{++}

(B) H^{+}

(C) K^{+}

(D) Na^{+}

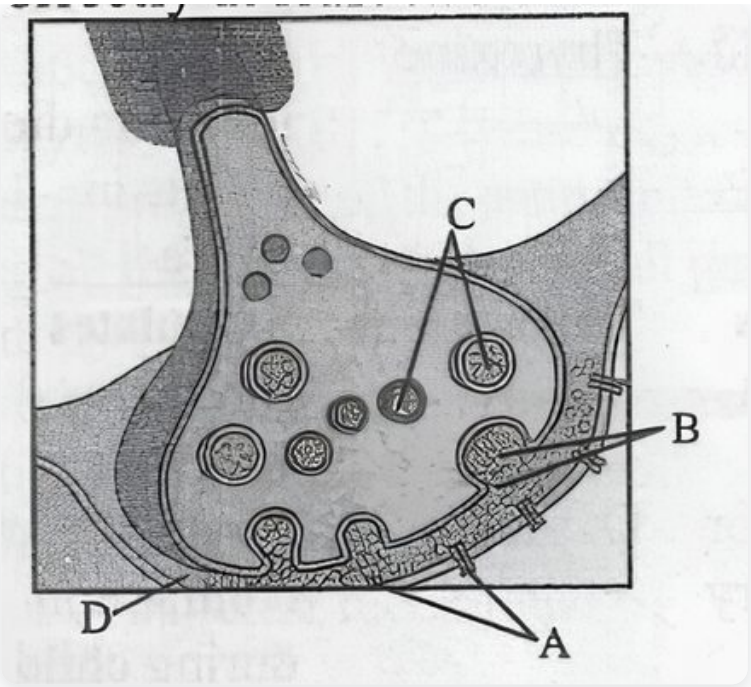
Explanation:

The most abundant intracellular cation is K+.

Question 131.

A diagram showing axon terminal and synapse is given. Identify correctly at least two of A-D.

[4 Marks]



(A) A-Neurotransmitter, B-Synaptic cleft

(B) B-Synaptic connection, D-K^+

(C) C-Neurotransmitter, D-Ca^{++}

(D) A-Receptor, C-Synaptic vesicles

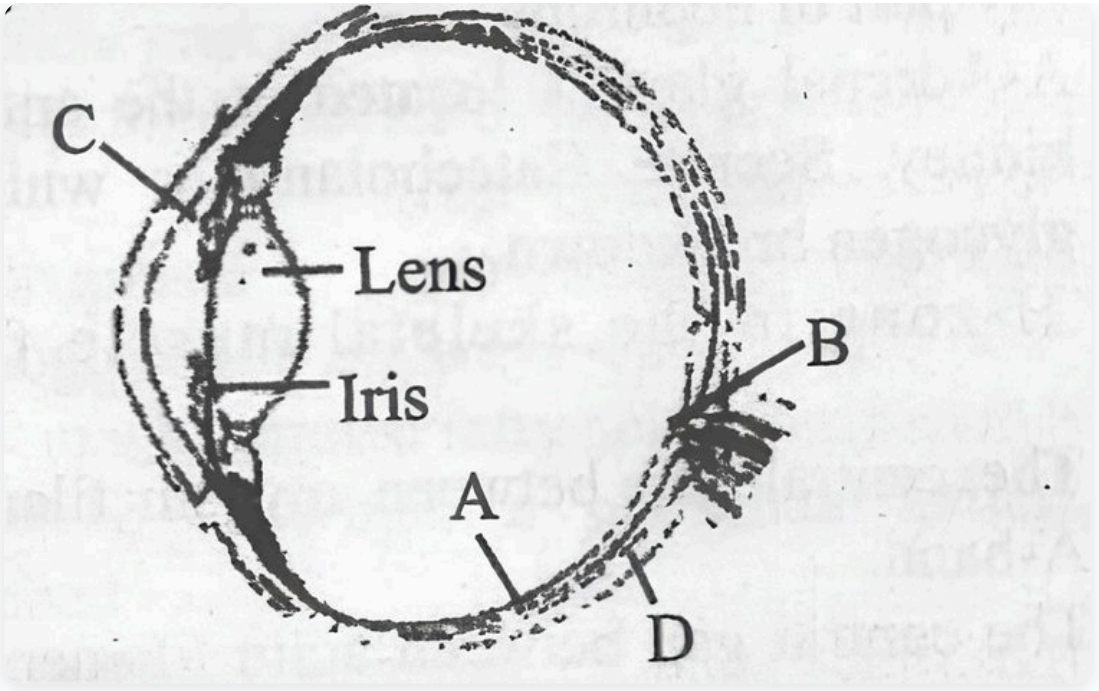
Explanation:

A-Receptor, B-Synaptic vesicles B' is synaptic cleft. A synapse is formed by the membranes of a synaptic neuron and post synaptic neuron, which may or may not separated by a gap called synaptic cleft. It is filled by fluid called neurotransmitter which are involved in transmission of impulse at these synapses.

Question 132.

Parts A, B, C and D of the human eye are shown in the diagram. Select the option which gives correct identification along with its functions/characteristics :

[4 Marks]



(A) B-Blind spot-has only a few rods and cones

(B) C-Aqueous chamber-reflects the light which does not pass through the lens

(C) D-Choroid-anterior part forms ciliary body

(D) A-Retina-contains photoreceptors-rods and cones

Explanation:

Retina is the innermost layer of eyeball and it contains three layers of cells - ganglion cells, bipolar cells and photoreceptor cells. Photoreceptor cells are not present in blind spot. The space between the cornea and the lens is called the aqueous chamber and contains a thin watery fluid called aqueous humor.
Choroid is anterior part of external sclera layer of eyeball while ciliary body is anterior part of middle choroid layer.

Question 133.

Which of the following statements is correct in relation to the endocrine system?

[4 Marks]

(A) Organs in the body like gastrointestinal tract, heart, kidney and liver do not produce any hormones.

(B) Non-nutrient chemicals produced by the body in trace amount that act as intercellular messengers are known as hormones.

(C) Releasing and inhibitory hormones are produced by the pituitary gland.

(D) Adenohypophysis is under direct neural regulation of the hypothalamus.

Explanation:

Hormones are non-nutrient chemicals which act as intercellular messengers and are produced in trace amounts. Gastrointestinal tracts secretes four major peptide hormones - gastrin, secretin, cholecystokinin (CCK) and gastric inhibitory peptide (GIP) while juxtaglomerular cells of kidney secretes erythropoietin, a peptide hormone. Releasing and inhibitory hormones are produced by hypothalamus. Neurohypophysis as posterior pituitary is under direct neural regulation of the hypothalamus.

Question 134.

A pregnant female delivers a baby who suffers from stunted growth, mental retardation, low intelligence quotient and abnormal skin. This is the result of :

[4 Marks]

(A) Cancer of the thyroid gland

(B) Low secretion of growth hormone

(C) Over secretion of pars distalis

(D) Deficiency of iodine in diet

Explanation:

Iodine is essential for the normal rate of hormone synthesis in the thyroid. Deficiency of iodine in our diet results in hypothyroidism and enlargement of the thyroid gland, commonly called goitre.

Question 135.

Select the answer which correctly matches the endocrine gland with the hormone it secretes and its function/deficiency symptom:

[4 Marks]

	Endocrine gland	Hormone	Function/ deficiency symptom
(a)	Posterior pituitary (GH)	Growth Hormone	oversecretion Stimulates abnormal growth
(b)	Thyroid gland	Thyroxine	Lack of iodine in diet results in goitre
(c)	Corpus luteum	Testosterone	Stimulates spermato-genesis
(d)	Anterior pituitary	Oxytocin	Stimulates uterus contraction during child birth

(A) Option (a)

(B) Option (d)

(C) Option (c)

(D) Option (b)

Explanation:

• Growth hormone secreted by Anterior pituitary

• Corpus luteum secreted Progesterone

• Oxytocin is secreted by Posterior pituitary

Question 136.

Select the wrong statement:

[4 Marks]

(A) In oomycetes female gamete is smaller and motile, while male gamete is larger and non-motile.

(B) Anisogametes differ either in structure, function or behaviour.

(C) Chlamydomonas exhibits both isogamy and anisogamy and Fucus shows oogamy.

(D) Isogametes are similar in structure, function and behaviour.

Explanation:

In oomycetes female gamete is large and non-motile while male gamete is small and motile

Question 137.

Monoecious plant of Chara shows occurrence of :

[4 Marks]

(A) stamen and carpel of the same plant

(B) antheridiophore and archegoniophore on the same plant

(C) upper antheridium and lower oogonium on the same plant

(D) upper oogonium and lower antheridium on the same plant

Explanation:

Male sex organ is called antheridium or globule while female sex organ is called oogonium. They develop on the same branchlet in the same plant in Chara.

Question 138.

Meiosis takes place in :

[4 Marks]

(A) Conidia

(B) Gemmule

(C) Megaspore

(D) Meiocyte

Explanation:

Meiosis takes place in meiocyte while conidia and gemmule are asexual structures and megaspore is female gametophyte i.e., embryosac.

Question 139.

Megasporangium is equivalent to

[4 Marks]

(A) Nucellus

(B) Fruit

(C) Ovule

(D) Embryo sac

Explanation:

Ovule is also called integumented megasporangium. It develops into seed after fertilisation in spermatophytes. It occurs singly or in a cluster inside ovary with parenchymatous cushions called placenta.

Question 140.

Advantage of cleistogamy is :

[4 Marks]

(A) No dependence of pollinators

(B) More vigorous offspring

(C) Vivipary

(D) Higher genetic variability

Explanation:

Cleistogamy favours no dependence on pollinator because flowers never open. In such flowers, the anthers and stigma lie close to each other. When anthers dehisce in flower buds pollen grains come in contact with the stigma to effect pollination.

Question 141.

Product of sexual reproduction generally generates :

[4 Marks]

(A) Prolonged dormancy

(B) Large biomass

(C) Longer viability of seeds

(D) New genetic combination leading to variation

Explanation:

Sexual reproduction leads to formation of new progeny with appearance of variations by Genetic recombination, of two different organisms interaction etc. During sexual reproduction provides vigour

and vitality to the offsprings. They better adapt themselves in changing environmental conditions and also plays an important role in evolution.

Question 142.

Which one of the following statements is correct?

[4 Marks]

(A) Sporogenous tissue is haploid

(B) Endothecium produces the microspores

(C) Hard outer layer of pollen is called intine

(D) Tapetum nourishes the developing pollen

Explanation:

Sporogenous tissue is always diploid, endothecium is second layer of anther wall and perform the function of protection and help in dehiscence of anther to release the pollen. Inner most layer of pollen is called exine but tapetum always nourishes the developing pollen.
Cells of the tapetum possess dense cytoplasm and generally have more than one nucleus (polyploid).

Question 143.

Perisperm differs from endosperm in :

[4 Marks]

(A) being a diploid tissue

(B) having no reserve food

(C) its formation by fusion of secondary nucleus with several sperms

(D) being a haploid tissue

Explanation:

Perisperm is remnants of nucellus which is diploid (2n) but endosperm is triploid (3n). Perisperm occurs in the seeds of Black pepper, coffee, castor, cardamum, Nymphaea. Endosperm is the food laden tissue which is meant for nourishing the embryo in seed plants. In angiosperms the endosperm is formed as a result of vegetative fertilization, triple fusion or fusion of a male gamete with diploid secondary nucleus of the central cell.

Question 144.

Seed coat is not thin, membranous in:

[4 Marks]

(A) Groundnut

(B) Coconut

(C) Gram

(D) Maize

Explanation:

The seed coat develops from integuments originally surrounding the ovule. It is thick and hard in coconut which protect the embryo from mechanical injury and from drying out.

Question 145.

Menstrual flow occurs due to lack of :

[4 Marks]

(A) Progesterone

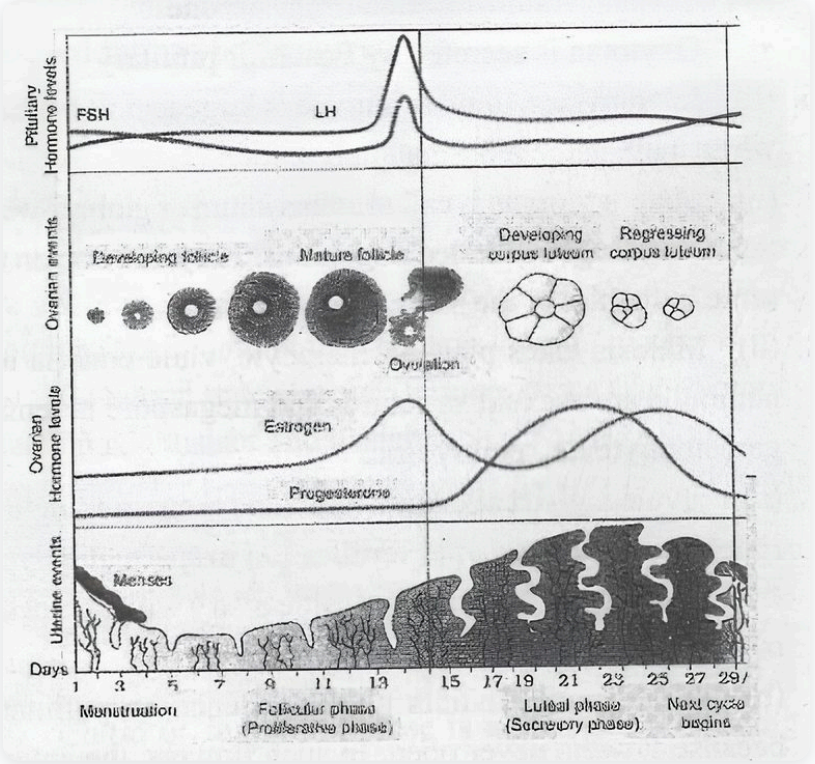
(B) FSH

(C) Vasopressin

(D) Oxytocin

Explanation:

During menstrual or bleeding phase which comprises of 3 - 5 days out of 28 days menstrual cycle, the production of LH from the anterior lobe of the pituitary gland is considerably reduced. The withdrawal of this hormone causes degeneration of corpus luteum and therefore, progesterone production is reduced. Production of estrogens is also reduced in this phase.



Question 146.

Which one of the following is not the function of placenta? It :

[4 Marks]

(A) secretes estrogen

(B) facilitates removal of carbon dioxide and waste material from embryo

(C) secretes oxytocin during parturition

(D) facilitates supply of oxygen and nutrients to embryo

Explanation:

Function of placenta - The placenta facilitate the supply of oxygen and nutrients to the embryo and also removal of carbon dioxide and excretory/waste materials produced by the embryo. The placenta is connected to the embryo through an umbilical cord which helps in the transport of substances to and from the embryo. Placenta also acts as an endocrine tissue and produces several hormones like human chorionic gonadotropin (hCG), human placental lactogen (hPL), estrogens, progesterone etc.

Question 147.

Which of the following cannot be detected in a developing foetus by amniocentesis?

[4 Marks]

(A) Down syndrome

(B) Sex of the foetus

(C) Klinefelter syndrome

(D) Jaundice

Explanation:

Jaundice cannot be detected in a developing foetus by amniocentesis. It is a foetal sex determination test based on chromosomal pattern in the amniotic fluid surrounding the developing embryo. It is now legally ban in India.

Question 148.

One of the legal methods of birth control is:

[4 Marks]

(A) by abstaining from coitus from day 10 to 17 of the menstrual cycle

(B) by having coitus at the time of day break

(C) by a premature ejaculation during coitus

(D) abortion by taking an appropriate medicine

Explanation:

Medical termination of pregnancy (MTP) or induced abortion become legal in India from 1971 with some strict conditions to avoid its misuse. Such restrictions are important to check indiscriminate and illegal female foeticides which are reported to be high in India. All the other options are of natural methods of contraception.

Question 149.

Artificial insemination means:

[4 Marks]

(A) Transfer of sperms of husband to a test tube containing ova

(B) Artificial introduction of sperms of a healthy donor into the vagina

(C) Transfer of sperms of a healthy donor to a test tube containing ova

(D) Introduction of sperms of a healthy donor directly into the ovary

Explanation:

In Artificial Insemination (AI) technique, the semen collected either from the husband or a healthy donor is artificially introduced either into the vagina or into the uterus (IUI - intrauterine insemination)

of the female.

Question 150.

If two persons with 'AB' blood group marry and have sufficiently large number of children these children could be classified as 'A' blood group: 'AB' blood group: 'B' blood group in 1 : 2 : 1 ratio. Modern technique of protein electrophoresis reveals presence of both 'A' and 'B' type proteins in 'AB' blood group individuals. This is an example of:

[4 Marks]

(A) Partial dominance

(B) incomplete dominance

(C) Complete dominance

(D) Codominance

Explanation:

ABO blood group system in human beings is an example of codominant, dominant recessive and multiple alleles. Blood groups are controlled by the gene I located on 9th chromosome that has 3 multiple alleles, out of which any two are found in a person. In codominance, both genes express themselves completely.

Question 151.

Which Mendelian idea is depicted by a cross in which the F_1 generation resembles both the parents?

[4 Marks]

(A) Law of dominance

(B) Incomplete dominance

(C) Inheritance of one gene

(D) Co-dominance

Explanation:

In co-dominance, F_1 generation resembles both the parents. Ex : Blood group inheritance.

Question 152.

Which of the following statements is not true of two genes that show 50% recombination frequency?

[4 Marks]

(A) The genes show independent assortment

(B) The genes are tightly linked

(C) If the genes are present on the same chromosome, they undergo more than one crossovers in every meiosis

(D) The genes may be on different chromosomes

Explanation:

Tightly linked genes show more linkage than crossing over.

Question 153.

If both parents are carriers for thalassemia, which is an autosomal recessive disorder, what are the chances of pregnancy resulting in an affected child?

[4 Marks]

(A) 50%

(B) 25%

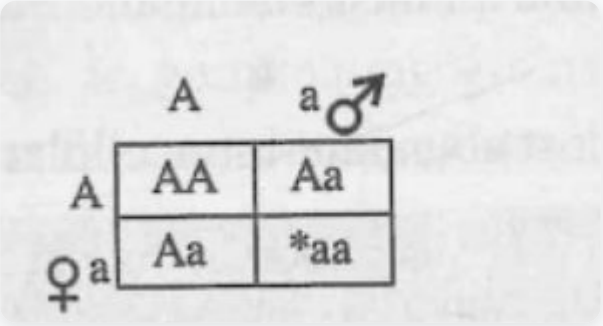
(C) no chance

(D) 100%

Explanation:

Genotype of carrier parents is - Aa (male parent) x Aa (female parent)

AA → normal child (25%)
Aa → carrier child (50%)
aa → affected child (25%)



Question 154.

The incorrect statement with regard to Haemophilia is:

[4 Marks]

(A) It is a recessive disease

(B) It is a dominant disease

(C) A single protein involved in the clotting of blood is affected

(D) It is a sex-linked disease

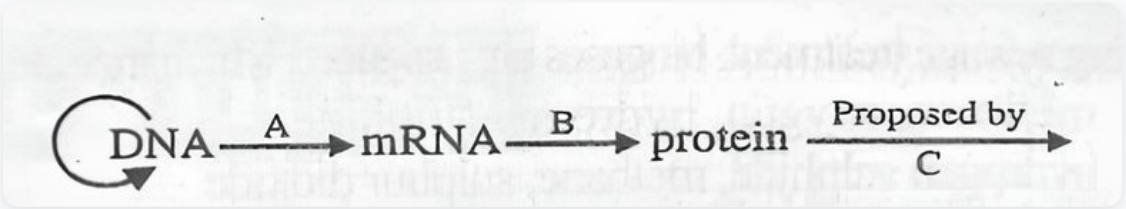
Explanation:

Haemophilia is sex linked recessive disease in which a simple protein that is a part of protein cascade involved in clotting of blood is affected. Due to this, in an affected individual, a simple cut will result in non-stop bleeding.

Question 155.

The diagram shows an important concept in the genetic implication of DNA. Fill in the blanks A to C.

[4 Marks]



(A) A-translation B-transcription C-Erwin Chargaff

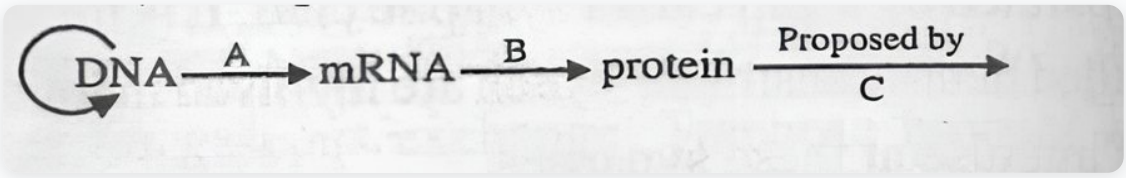
(B) A-translation B-extension C-Rosalind Franklin

(C) A-transcription B-translation C-Francis Crick

(D) A-transcription B-replication C-James Watson

Explanation:

In this question A is transcription, B - translation and C is Francis Crick (central dogma). It is unidirectional flow of information from DNA to mRNA (transcription) and then decoding the information present in mRNA in the formation of polypeptide chain or protein (translation).



Question 156.

Which enzymes will be produced in a cell in which there is a nonsense mutation in the lac Y gene?

[4 Marks]

(A) Transacetylase

(B) Lactose permease

(C) Lactose permease and transacetylase

(D) β-galactosidase

Explanation:

A nonsense mutation is the one which stops polypeptide synthesis due to formation of a terminating or nonsense codon e.g. ATT (UAA), ATC (UAG), ACT (UGA). The lactose or lac operon of Escherichia coli contains structural genes (z, y, a). If y codes for termination of polypeptide chain then only the product of 'z' gene transcribe to form beta galactosidase.

Question 157.

The eye of octopus and eye of cat show different patterns of structure, yet they perform similar function. This is an example of

[4 Marks]

(A) Analogous organs that have evolved due to divergent evolution

(B) Homologous organs that have evolved due to divergent evolution.

(C) Analogous organs that have evolved due to convergent evolution.

(D) Homologous organs that have evolved due to convergent evolution

Explanation:

The eye of octopus and eye of cat show different patterns of structure, yet they perform similar functions. This is an example of analogous organs.
Analogous organs have evolved due to convergent evolution. Analogous organs have developed in the evolutionary process through adaptation of quite different organisms to similar mode of life.

Question 158.

The process by which organisms with different evolutionary history evolve similar phenotypic adaptations in response to a common environmental challenge, is called:

[4 Marks]

(A) Convergent evolution

(B) Natural selection

(C) Non-random evolution

(D) Adaptive radiation

Explanation:

The wings is a classic example of convergent evolution. Flying insects, birds and bats all evolved the capacity of flight independently. All four serve the same function and are similar in structure but anatomically different.

Question 159.

Variation in gene frequencies within populations can occur by chance rather than by natural selection. This is referred to as:

[4 Marks]

(A) Genetic drift

(B) Genetic flow

(C) Genetic load

(D) Random mating

Explanation:

Genetic drift is variation in gene frequencies within populations can occur by chance rather than by natural selection, sometimes the change in allele frequency is so

Question 160.

According to Darwin, the organic evolution is due to:

[4 Marks]

(A) Interspecific competition

(B) Intraspecific competition

(C) Competition within closely related species

(D) Reduced feeding efficiency in one species

Explanation:

According to Darwin the organic evolution is due to interspecific competition. Individuals of same species have variation in characteristics. Those characteristics which enable some to survive better in natural conditions (climate, food, physical factors etc.) would outbreed others that are less-endowed to survive under such natural conditions. These, therefore, will survive more and hence are selected by nature. He called it natural selection and implied it as a mechanism of evolution.

Question 161.

Infection of Ascaris usually occurs by:

[4 Marks]

(A) eating imperfectly cooked pork.

(B) Mosquito bite.

(C) Tsetse fly.

(D) drinking water containing eggs of Ascaris.

Explanation:

Ascaris, an intestinal parasite causes ascariasis. Symptoms of these disease include internal bleeding, muscular pain, fever, anemia and blockage of the intestinal passage. The eggs of the parasite are excreted along with the feces of infected persons which contaminate soil, water, plants, etc. A healthy person acquires this infection through contaminated water vegetables, fruits, etc.

Question 162.

The cell-mediated immunity inside the human body is carried out by:

[4 Marks]

(A) B-lymphocytes

(B) Thrombocytes

(C) Erythrocytes

(D) T-lymphocytes

Explanation:

T - lymphocytes mediate cell mediated immunity (CMI). It is one of the two types of acquired immunity responsible for graft or transplant rejection.

Question 163.

In plant breeding programmes, the entire collection (of plants/seeds) having all the diverse alleles for all genes in a given crop is called:

[4 Marks]

(A) cross-hybridisation among the selected parents

(B) evaluation and selection of parents.

(C) selection of superior recombinants.

(D) germplasm collection

Explanation:

Germplasm collection is the first step of plant breeding programmes. As genetic variability is the root of any breeding programmes. In many crops pre-existing genetic variability is available from wild relatives of the crop.

Question 164.

During sewage treatment, biogases are produced which include :

[4 Marks]

(A) methane, oxygen, hydrogen sulphide

(B) hydrogen sulphide, methane, sulphur dioxide

(C) methane, hydrogen sulphide, carbon dioxide

(D) hydrogen sulphide, nitrogen, methane

Explanation:

The major component of biogas is methane (about 50-68%) which is highly inflammable. The other gases are carbon dioxide (25-35%), hydrogen (1-5%), nitrogen (2-7%), Oxygen (0-0.1%) and rarely hydrogen sulfide. Biogas is a "mixture of gases" produced from degradable organic matter by the activity of various anaerobic bacteria that offers a low cost alternative for energy requirements.

Question 165.

A good producer of citric acid is:

[4 Marks]

(A) Clostridium

(B) Pseudomonas

(C) Saccharomyces

(D) Aspergillus

Explanation:

A good source of citric acid is Aspergillus niger (a fungus). Apart from citric acid, oxalic acid, gallic acid, gluconic acid are extracted from fungus.

Question 166.

The colonies of recombinant bacteria appear white in contrast to blue colonies of non-recombinant bacteria because of:

[4 Marks]

(A) Insertional inactivation of alpha-galactosidase in non-recombinant bacteria

(B) Inactivation of glycosidase enzyme in recombinant bacteria

(C) Insertional inactivation of alpha-galactosidase in recombinant bacteria

(D) Non-recombinant bacteria containing beta-galactosidase

Explanation:

Alternative selectable markers have been developed

which differentiate recombinant from non-recombinants on the basis of their ability to produce colour in the presence of chromogenic substrate. It this, a recombinant DNA is inserted within the coding sequence of an enzyme β-galactosidase. This results into inactivation of the enzyme, which is referred to as insertional inactivation. The presence of chromogenic substrate gives blue coloured colonies of the plasmid in the bacteria that does not have an insert. Presence of insert results into insertional inactivation of the galactosidase and the colonies do not produce any colour; these are identified as recombinant colonies.

Question 167.

DNA fragments generated by the restriction endonucleases in a chemical reaction can be separated by:

[4 Marks]

(A) Polymerase chain reaction

(B) Electrophoresis

(C) Restriction mapping

(D) Centrifugation

Explanation:

In a chemical reaction DNA fragments generated by restriction endonucleases, can be separated by gel electrophoresis. Since DNA fragments are negatively charged molecules, they can be separated by forcing them to move towards the anode under an electric field through a medium/matrix. The DNA fragments separate according to their size through sieving effect provided by matrix.

Question 168.

Which of the following Bt crops is being grown in India by the farmers?

[4 Marks]

(A) Cotton

(B) Brinjal

(C) Soybean

(D) Maize

Explanation:

Bt cotton is being grown in India by the farmers. Bt cotton is pest resistant plant which could decrease the pesticides used. *Bt* toxin is produced by a bacterium *Bacillus thuringiensis* (BT for short). *Bt* toxin gene has been cloned from the bacteria and been expressed in plants to provide resistance to insects without the need for insecticides.

Question 169.

A sedentary sea anemone gets attached to the shell lining of hermit crab. The association is:

[4 Marks]

(A) Symbiosis

(B) Commensalism

(C) Amensalism

(D) Ectoparasitism

Explanation:

Commensalism is an interaction where one species is benefitted and other is neither benefitted nor harmed.

Question 170.

A biologist studied the population of rats in a barn. He found that the average natality was 250, average mortality 240, immigration 20 and emigration 30. The net increase in population is:

[4 Marks]

(A) 15

(B) 05

(C) 10

(D) zero

Explanation:

Net increase in population:
(Natality + Immigration) – (Mortality + Emigration)
= (250 + 20) – (240 + 30) = 270 – 270 = 0

Question 171.

Which one of the following processes during decomposition is correctly described?

[4 Marks]

(A) Humification – Leads to the accumulation of a dark coloured stable humus which undergoes microbial action at a very fast rate.

(B) Catabolism – Last step in decomposition under fully anaerobic condition.

(C) Leaching – Water soluble inorganic nutrients rise to the top layers of soil.

(D) Fragmentation – Carried out by organisms such as earthworm

Explanation:

Humification, catabolism, leaching and fragmentation are the steps of decomposition which operate simultaneously on the detritus. Fragmentation is breaking down detritus into smaller particles by detritivores like earthworm. By the process of leaching, water soluble inorganic nutrients go down into soil horizon and get precipitated as unavailable salts. Humification occurs at very slow rate.

Question 172.

Secondary productivity is rate of formation of new organic matter by:

[4 Marks]

(A) Producer

(B) Decomposer

(C) Consumer

(D) Parasite

Explanation:

The rate of resynthesis of organic matter by the consumers is known as secondary productivity. It depends upon the loss while transferring energy containing organic matter from the previous trophic level plus the consumption due to respiration and predation. Respiration loss is about 20% for autotrophs, 30% for herbivores and up to 60% in case of carnivores. Therefore, net productivity decreases with each trophic level.

Question 173.

Natural reservoir of phosphorus is:

[4 Marks]

(A) Animal bones

(B) Rock

(C) Fossils

(D) Sea water

Explanation:

The natural reservoir of phosphate is rock, which contains phosphorus in the form of phosphates. When rocks are weathered, minute amounts of these phosphates dissolve in the soil solution and are absorbed by the roots of plants. Herbivores and other animals obtain this element from plants.

Question 174.

Which of the following represent maximum number of species among global biodiversity?

[4 Marks]

(A) Algae

(B) Mosses and Ferns

(C) Lichens

(D) Fungi

Explanation:

The number of species of fungi is maximum with respect to other options. The number of fungal species in the world is more than the combined total of species of fishes, amphibians, reptiles and mammals.

Question 175.

Which one of the following is **not** used for ex-situ plant conservation?

[4 Marks]

(A) Field gene banks

(B) Botanical Gardens

(C) Shifting cultivation

(D) Seed banks

Explanation:

Shifting or Jhum cultivation contributes to deforestation.

Ex-situ conservation is a biodiversity conservation method in which threatened animals and plants are taken out of their natural habitat and placed in protected environments such as zoological parks, botanical gardens, wildlife safari parks, seed banks, and gene banks.

Question 176.

The Air (Prevention and Control of Pollution) Act came into force in:

[4 Marks]

(A) 1981

(B) 1985

(C) 1990

(D) 1975

Explanation:

In India, the Air (Prevention and control of ‘pollution)

Act came into force in 1981 but was amended in 1987 to

include noise as an air pollutant.

Question 177.

Kyoto Protocol was endorsed at:

[4 Marks]

(A) CoP-6

(B) CoP-5

(C) CoP-4

(D) CoP-3

Explanation:

In December 1997, at the Conference of Parties III (COP-3) in Kyoto, Japan, the Kyoto Conference on Climate Change took place. During this conference, developed countries agreed to specific targets for cutting their emissions of greenhouse gases. A general framework was defined, with specific details to be finalised in the following years. This agreement became known as the Kyoto Protocol.

Question 178.

Global warming can be controlled by:

[4 Marks]

(A) Reducing reforestation, increasing the use of fossil fuel.

(B) Increasing deforestation, slowing down the growth of human population.

(C) Increasing afforestation, reducing efficiency of energy usage.

(D) Reducing deforestation, cutting down use of fossil fuel.

Explanation:

In the first three options, CO_2 concentration increases, whereas it decreases in option (d). Global warming is the increase in the Earth's average temperature. It is caused by the greenhouse effect, a naturally occurring phenomenon responsible for heating the Earth's surface and atmosphere. The major greenhouse gas is carbon dioxide (CO_2).

Question 179.

The first stable product of fixation of atmospheric nitrogen in leguminous plants is:

[4 Marks]

(A) Ammonia

(B) NO_2^-

(C) NO_3^-

(D) Glutamate

Explanation:

The process of conversion of nitrogen (N_2) to ammonia is termed nitrogen fixation.

$N_2 \rightarrow N_2H_2 \rightarrow N_2H_4 \rightarrow 2NH_3$

(Nitrogen) → (Diimide) → (Hydrazine) → (Ammonia)

$2NH_3 + 3O_2 \rightarrow 2NO_2^- + 2H^+ + 2H_2O$

$2NO_2^- + O_2 \rightarrow 2NO_3^-$

In reductive amination, ammonia reacts with alpha-ketoglutaric acid and forms glutamic acid.

α-Ketoglutaric acid + NH_4^+ + NADPH → Glutamate + H_2O + $NADP^+$

Question 180.

Which of the following metabolites is common to respiration-mediated breakdown of fats, carbohydrates and proteins?

[4 Marks]

(A) Glucose 6-phosphate

(B) Fructose 1,6-bisphosphate

(C) Pyruvic acid

(D) Acetyl Co-A

Explanation:

Acetyl-CoA is common to respiration-mediated breakdown of fats, carbohydrates, and proteins.

Glucose and fructose are phosphorylated to give glucose-6-phosphate by the activity of the enzyme hexokinase. Glucose-6-phosphate is then converted into fructose-6-phosphate, and further into fructose-1,6-bisphosphate.

Pyruvic acid is the end product of glycolysis.