NEET-UG EXAMINATION PAPER-2017

(Solved)

Time allowed : 3 hours | Maximum Marks : 721

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.

A physical quantity of the dimensions of length that can be formed out of c, G and $e^2/4\pi\epsilon_0$ [c is velocity of light, G is universal constant of gravitation and e is charge

[4 Marks]

(A) $1/c^2\ [e^2/G4\pi\epsilon_0]^{-1/2}$

(B) $1/c\ G\ e^2/4\pi\epsilon_0$

(C) $1/c^2\ [\ G\ e^2/4\pi\epsilon_0]^{-1/2}$

(D) $c^2\ [Ge^2/4\pi\epsilon_0]^{1/2}$

Explanation:

Let dimensions of length is related as,

$[L] = [c]^x\ [G]^y\ [\ e^2/4\pi\epsilon_0\ ]^z$

$\Rightarrow e^2/4\pi\epsilon_0 = [ML^3T^{-2}]$

$[L] = [LT^{-1}]^x [M^{-1}L^3T^{-2}]^y [ML^3T^{-2}]^z$

$[L] = [L^{x+3y+3z} M^{-y+z} T^{-x-2y-2z}]$

Comparing both sides

$-y + z = 0 \Rightarrow Z$ ...(i)

$x + 3y + 3z = 1$ ...(ii)

$-x - 4z = 0 (\because y = z)$ ...(iii)

From (i), (ii) and (iii)

$z = y = -1/2$; $x = -2$

Hence,

$[L] = c^{-2} [G \cdot e^2/4\pi\epsilon_0]^{1/2}$

Question 2.

Preeti reached the metro station and found that the escalator was not working. She walked up the stationary escalator in time t_1. On other days, if she remains stationary on the moving escalator, then the escalator takes her up in time t_2. The time taken by her to walk up on the moving escalator will be

[4 Marks]

(A) $t_1 - t_2$

(B) $t_1t_2/(t_2 - t_1)$

(C) $(t_1 + t_2)/2$

(D) $t_1t_2/(t_2 + t_1)$

Explanation:

Let the distance be 'd' time taken by Preeti to travel up the stationary escalator = t_1

Velocity of Preeti w.r.t. elevator

$v_1 = d/t_1$

Since the distance is same let the time taken when Preeti stands on the moving escalator = t_2.

Velocity of elevator w.r.t. ground

$v_2 = d/t_2$

The net velocity of Preeti w.r.t. ground

$v = v_1 + v_2$

$d/t = d/t_1 + d/t_2$

$1/t = 1/t_1 + 1/t_2$

$t = t_1t_2/(t_1 + t_2)$

(time taken by Preeti to walk up the moving escalator)

Question 3.

The x and y coordinates of the particle at any time are
$x = 5t - 2t^2$ and $y = 10t$ respectively, where x and y are in me

[4 Marks]

(A) 5 m/s²

(B) 0

(C) −8 m/s²

(D) −4 m/s²

Explanation:

Given:

$x = 5t - 2t^2$ $y = 10t$

$v_x = dx/dt = 5 - 4t$
$v_y = dy/dt = 10$

$a_x = dv_x/dt = -4$ $a_y = dv_y/dt = 0$

□□ = $a_x\hat{i} + a_y\hat{j}$

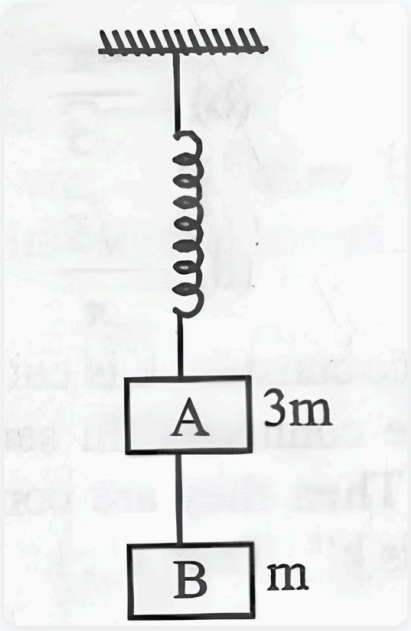
□□ = $-4\hat{i}$ m/s²

Hence, acceleration of particle at (t = 2 s) = −4 m/s²

Question 4.

Two blocks A and B of masses 3m and m respectively are connected by a massless and inextensible string. The whole system is suspended by a massless spring as shown in figure. The magnitudes of acceleration of A and B immediately after the string is cut, are respectively:

[4 Marks]



(A) g/3,g

(B) g/3,g/3

(C) g,g/3

(D) g,g

Explanation:

Before cutting the string

$kx = T + 3mg$ ...(i)

$T = mg$ ..(ii)

Force on spring,

$\Rightarrow kx = 4mg$

After cutting the string $T = 0$

For block A:

$3ma_A = 4mg - 3mg$

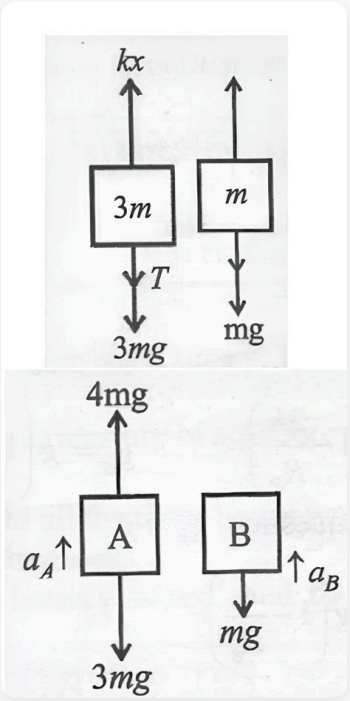
$a_A = (4mg - 3mg)/3m = g/3$

$a_A = g/3$

For block B:

ma_B= mg

a_B = g



Question 5.

One end of string of length l is connected to a particle of mass 'm' and the other end is connected to a small peg on a smooth horizontal table. If the particle moves in circle with speed 'v' then the net force on the particle (directed towards centre) will be (T represents the tension in the string):

[4 Marks]

(A) T + mv^2/l

(B) T − mv^2/l

(C) T

(D) Zero

Explanation:

Net force on particle in uniform circular motion is centripetal force (mv^2/ℓ) which is provided by tension in string so the net force will be equal to tension i.e., T.

Question 6.

Two discs of same moment of inertia rotating about their regular axis passing through centre and perpendicular to the plane of disc with angular velocities ω_1 and ω_2. They are brought into contact face to face coinciding the axis of rotation. The expression for loss of energy during this process is:

[4 Marks]

(A) $I(\omega_1 - \omega_2)^2$

(B) $1/4\ I(\omega_1 - \omega_2)^2$

(C) $1/2\ I(\omega_1 + \omega_2)^2$

(D) $1/8\ I(\omega_1 - \omega_2)^2$

Explanation:

Here, $I\omega_1 + |\omega_2 = 2I\omega$

$\Rightarrow \omega = (\omega_1 + \omega_2)/2$

$(K.E.)_i = 1/2\ I\omega_1^2 + 1/2\ I\omega_2^2$

$(K.E.)\square = 1/2 \times 2I\omega^2 = I[(\omega_1 + \omega_2)/2]^2$

Loss in K.E. = $(K.E.)\square_i - (K.E.)_i = 1/4\ I(\omega_1 - \omega_2)^2$

Question 7.

A rope is wound around a hollow cylinder of mass 3 kg and radius 40 cm. What is the angular acceleration of the cylinder if the rope is pulled with a force of 30 N?

[4 Marks]

(A) 25 rad/s²

(B) 0.25 rad/s²

(C) 5 m/s²

(D) 25 m/s²

Explanation:

Given, mass of cylinder m = 3 kg

R = 40 cm = 0.4 m

F = 30 N ; α = ?

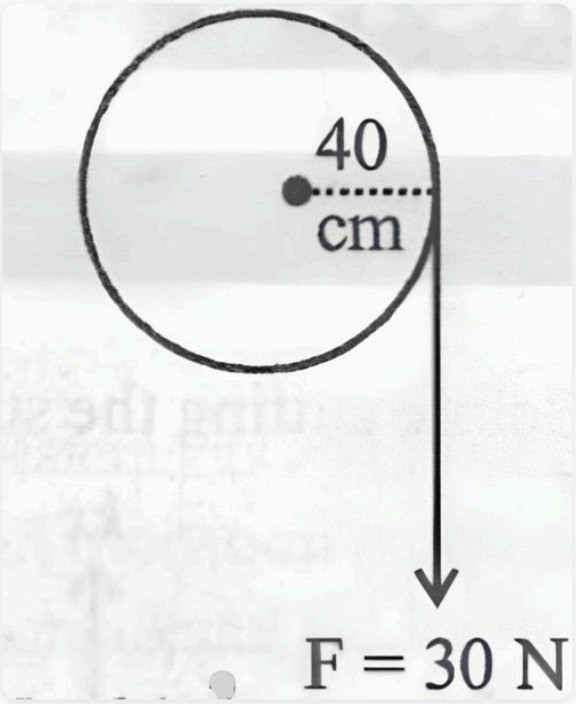
As we know, torque $\tau = I\alpha$

$F \times R = MR^2\alpha$

$\alpha = (F \times R)/(MR^2)$

$\alpha = (30 \times 0.4)/(3 \times (0.4)^2)$

or, $\alpha = 25\ rad/s^2$



Question 8.

Two astronauts are floating in gravitation free space after having lost contact with their spaceship. The two will

[4 Marks]

(A) keep floating at the same distance between them.

(B) become stationary

(C) move towards each other.

(D) move away from each other.

Explanation:

Both the astronauts are in the condition of 'weightlessness. Gravitational force between them pulls towards each other. Hence Astronauts move towards each other under mutual gravitional force.

Question 9.

The acceleration due to gravity at a height 1 km above the earth is the same as at a depth d below the surface of earth. Then

[4 Marks]

(A) d = 3/2 km

(B) d = 1 km

(C) d = 2 km

(D) d = 1/2 km

Explanation:

Above earth surface Below earth surface
$g_h = g(1 - 2h/R_e)$ $g_d = g(1 - d/R_e)$
According to question, $g_h = g_d$
$g(1 - 2h/R_e) = g(1 - d/R_e)$
Clearly,
$d = 2h = 2$ km

Question 10.

The bulk modulus of a spherical object is 'B'. If it is subjected to uniform pressure 'p', the fractional decrease in radius is

[4 Marks]

(A) 3p/B

(B) p/3B

(C) p/3B

(D) p/B

Explanation:

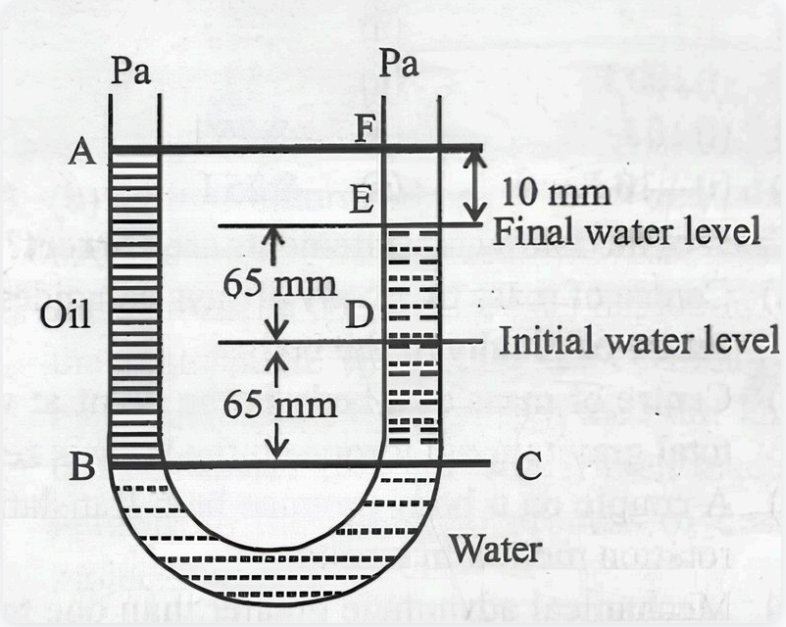
Bulk modulus is given by
$B = p/(\Delta V/V)$
or
$\Delta V/V = p/B$
$3\,\Delta R/R = p/B$ (here, $\Delta R/R$ = fractional decrease in radius)

$\Rightarrow \Delta R/R = p/3B$

Question 11.

A U tube with both ends open to the atmosphere, is partially filled with water. Oil, which is immiscible with water, is poured into one side until it stands at a distance of 10 mm above the water level on the other side. Meanwhile the water rises by 65 mm from its original level (see diagram).

[4 Marks]



(A) 928 kg m^{-3}

(B) 800 kg m^{-3}

(C) 425 kg m^{-3}

(D) 650 kg m^{-3}

Explanation:

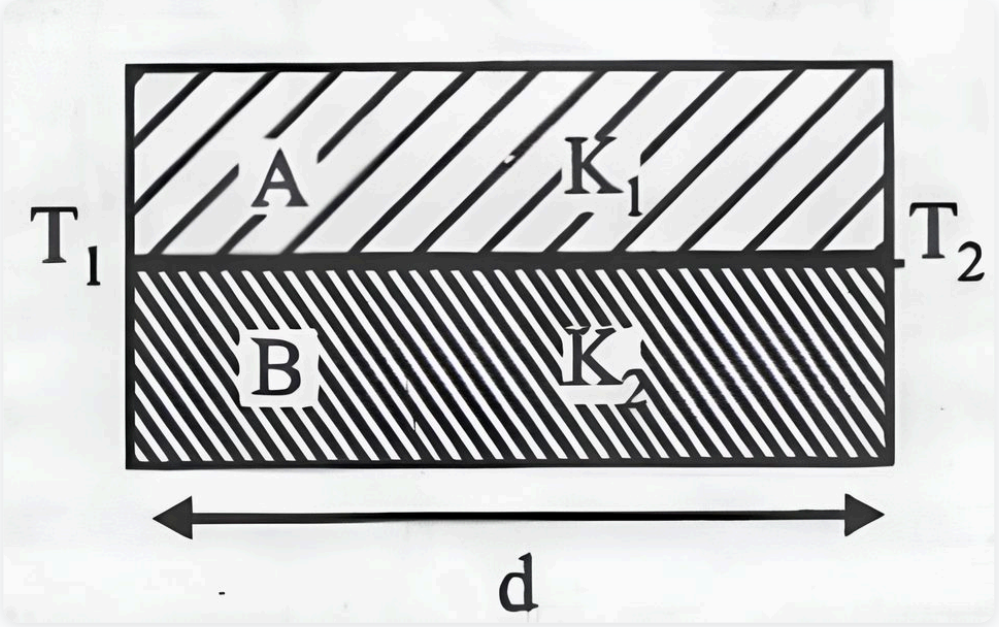
Here, $h_{oil} \times \rho_{oil} \times g = h(water)subscript \times \rho(water)subscript \times g$
$\rho_0 g \times 140 \times 10^{-3} = \rho_w\ g \times 130 \times 10^{-3}$
$\rho_{oil} = 130/140 \times 10^3 \approx 928\ kg/m^3$

[$\because \rho_w = 1\ kgm^{-3}$]

Question 12.

Two rods A and B of different materials are welded together as shown in figure. Their thermal conductivities are K_1 and K_2. The thermal conductivity of the composite rod will be :

[4 Marks]



(A) $(K_1 + K_2)/2$

(B) $2(K_1 + K_2)$

(C) $K_1 + K_2$

(D) $3(K_1 + K_2)/2$

Explanation:

quivalent thermal conductivity of the composite rod in parallel combination will be,
$K = K_1A(T_1 - T_2)/d + K_2A(T_1 - T_2)/d$
K_EQ $2A(T_1 - T_2)/d = A(T_1 - T_2)/d [K_1 + K_2]$
Hence equivalent thermal conductivities for two rods of
equal area is given by
K_EQ $= (K_1 + K_2)/2$

Question 13.

A spherical black body with a radius of 12 cm radiates 450 watt power at 500 K. If the radius were halved and the temperature doubled, the power radiated in watt would be

[4 Marks]

(A) 450

(B) 1000

(C) 1800

(D) 225

Explanation:

Given r_1 = 12 cm, r_2 = 6 cm

T_1 = 500 K and T_2 = 2 × 500 = 1000 K

P_1 = 450 watt

Rate of power loss $P \propto r^2T^4$

$P_1/P_2 = r_1^2T_1^4/r_2^2T_2^4$

$P_2 = P_1(r_2^2T_2^4)/(r_1^2T_1^4)$

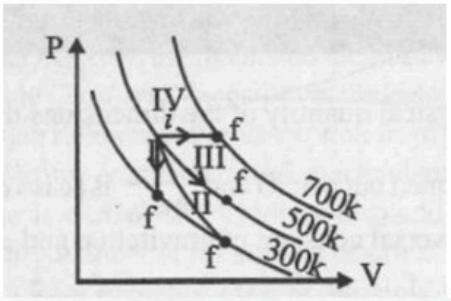
Solving we get,

P_2 = 1800 watt

Question 14.

Thermodynamic processes are indicated in the following diagram:

[4 Marks]



	Column-1		Column-2
P.	Process I	A.	Adiabatic
Q.	Process II	B.	Isobaric
R.	Process III	C.	Isochoric
S.	Process IV	D.	Isothermal

(A) P → D, Q → B, R → A, S → C

(B) P → A, Q → C, R → D, S → B

(C) P → C, Q → A, R → D, S → B

(D) P → C, Q → D, R → B, S → A

Explanation:

Process I volume is constant hence, it is isochoric.
In process IV, pressure is constant hence, it is isobaric

Question 15.

A carnot engine having an efficiency of 1/10 as heat engine, is used as a refrigerator. If the work done on the system is 10 J, the amount of energy absorbed from the reservoir at lower temperature is

[4 Marks]

(A) 90 J

(B) 99 J

(C) 100 J

(D) 1 J

Explanation:

Given, efficiency of engine,

$\eta = 1/10$

work done on system $W = 10$ J

Coefficient of performance of refrigerator,

$\beta = Q_2/W = (1 - \eta)/\eta$

$= (1 - 1/10)/(1/10)$

$= (9/10)/(1/10)$

$= 9$

Energy absorbed from reservoir,

$Q_2 = \beta W$

$Q_2 = 9 \times 10 = 90$ J

Question 16.

A gas mixture consists of 2 moles of O_2 and 4 moles of Ar at temperature T. Neglecting all vibrational modes, the total internal energy of the system is:

[4 Marks]

(A) 9RT

(B) 11RT

(C) 15RT

(D) 4RT

Explanation:

Internal energy of the system is given by
U = f/2 nRT
Degree of freedom

F_diatomic = 5
F_monatomic) = 3
and, number of moles
$n(O_2) = 2$
n(Ar) = 4
U_total = 5/2 (2)RT + 3/2 (4)RT = 11RT

Question 17.

A particle executes linear simple harmonic motion with an amplitude of 3 cm. When the particle is at 2 cm from the mean position, the magnitude of its velocity is equal to that of its acceleration. Then its time period in seconds is

[4 Marks]

(A) √5/π

(B) 2π/√3

(C) 4π/√5

(D) √5/2π

Explanation:

Given, Amplitude A = 3 cm
When particle is at x = 2 cm
According to question, magnitude of velocity = acceleration
$\omega\sqrt{(A^2 - x^2)} = x\omega^2$
$\sqrt{(3)^2 - (2)^2} = 2(2\pi/T)$
$\sqrt{5} = 4\pi/T$
$\Rightarrow T = 4\pi/\sqrt{5}$

Question 18.

A spring of force constant k is cut into lengths of ratio 1 : 2 : 3. They are connected in series and the new force constant is k'. Then they are connected in parallel and force constant is k''. Then k' : k'' is

[4 Marks]

(A) 1:14

(B) 1:6

(C) 1:9

(D) 1:11

Explanation:

Let ℓ be the complete length of spring.
Length when cut in ratio 1 : 2 : 3 are
ℓ/6, ℓ/3 and ℓ/2
Spring constant (k) ∝ 1/length (ℓ)
Spring constant for given segments
k_1, 6k, k_2 =3k and k_3 =2k
When they are connected in series
1/k′ = 1/6k + 1/3k + 1/2k
⇒ 1/k′ = 6/6k
∴ Force constant k′ = k
And when they are connected in parallel
k″ = 6k + 3k + 2k
⇒ k″ = 11k
Then the ratios
k /k″ =1/11 i.e., 1 : 11

Question 19.

The two nearest harmonics of a tube closed at one end and open at other end are 220 Hz and 260 Hz. What is the fundamental frequency of the system?

[4 Marks]

(A) 30 Hz

(B) 10 Hz

(C) 40 Hz

(D) 20 Hz

Explanation:

Difference in two successive frequencies of closed pipe, 2v/4l ⇒ 260 - 220= 40 Hz

or
2v/4ℓ = 40 Hz
⇒ v/4ℓ = 20 Hz
Which is the fundamental frequency of system of closed organ pipe.

Question 20.

Two cars moving in opposite directions approach each other with speed of 22 m/s and 16.5 m/s respectively. The driver of the first car blows a horn having a frequency 400 Hz. The frequency heard by the driver of the second car is (velocity of sound 340 m/s):

[4 Marks]

(A) 361 Hz

(B) 411 Hz

(C) 448 Hz

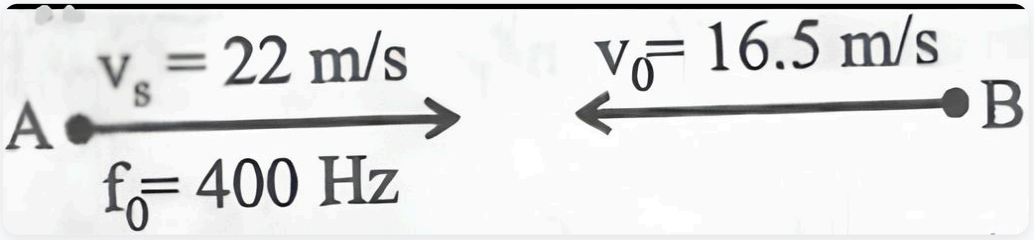
(D) 350 Hz

Explanation:

As we known from Doppler's Effect

$f_{apparent} = f_0 [(v + v_0)/(v - v_s)] = 400 [(340 + 16.5)/(340 - 22)]$

$f_{apparent} = 448$ Hz



Question 21.

Suppose the ratio of proton and electron differ slightly. One of them is −e, the other is (e + Δe). If the net of electrostatic force and gravitational force between two hydrogen atoms placed at a distance d (much greater than atomic size) apart is zero, then Δe is of the order of [Given mass of hydrogen $m_h = 1.67 \times 10^{-27}$ kg]

[4 Marks]

(A) 10^{-47} C

(B) 10^{-20} C

(C) 10^{-37} C

(D) 10^{-23}C

Explanation:

Net charge on one H atom = −e + (e + Δe) = Δe

According to question, the net electrostatic force (F_E) = gravitational force (F_G)

F_E = F_G

or

$1/4\pi\epsilon_0 \cdot \Delta e^2/d^2 = Gm^2/d^2$

$\Rightarrow \Delta e = m\sqrt{(G/k)}$ [$\because 1/4\pi\epsilon_0 = k = 9 \times 10^9$]

$= 1.67 \times 10^{-27} \sqrt{(6.67 \times 10^{-11} / 9 \times 10^9)}$

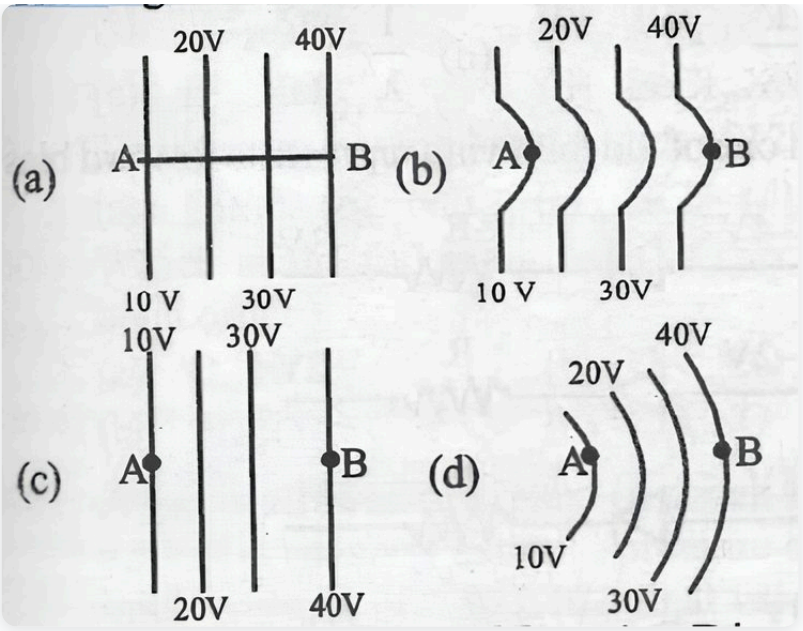
$\Delta e \approx 1.436 \times 10^{-37}$ C

Question 22.

The diagrams below show regions of equipotentials.

A positive charge is moved from A to B in each diagram.

[4 Marks]



(A) In all the four cases the work done is the same

(B) Maximum work is required to move q in figure (c)

(C) Minimum work is required to move q in figure (a)

(D) Maximum work is required to move q in figure (b)

Explanation:

As the regions are of equipotentials, so Work done

$W = q\Delta V$

ΔV is same in all the cases hence work done will also be same in all the cases.

Question 23.

A capacitor is charged by a battery. The battery is removed and another identical uncharged capacitor is connected in parallel. The total electrostatic energy of resulting system:

[4 Marks]

(A) remains the same

(B) decreases by a factor of 2

(C) increases by a factor of 2

(D) increases by a factor of 4

Explanation:

When battery is replaced by another uncharged

capacitor

As uncharged capacitor is connected parallel

So, $C' = 2C$

and $V_c = (q_1 + q_2)/(C_1 + C_2)$

$V_c = (q + 0)/(C + C) = CV/(C + C)$ [$\because q = CV$]

$\Rightarrow V_c = V/2$

Initial Energy of system, $U_i = 1/2\ CV^2$ ...(i)

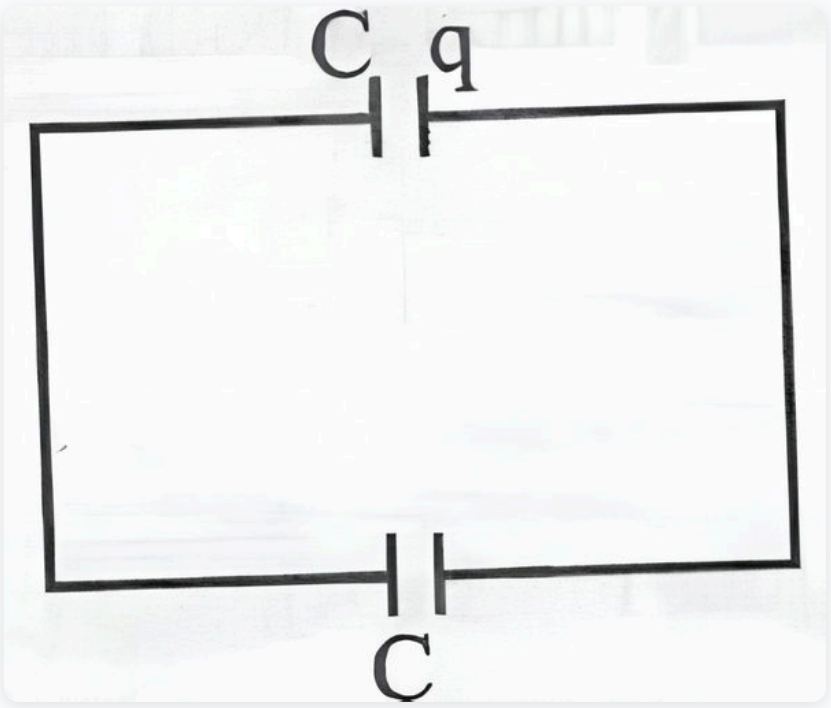
Final energy of system, $U_f = 1/2\ (2C)(V/2)^2$

$= 1/2\ CV^2\ (1/2)$ ...(ii)

From equation (i) and (ii)

$U_f = 1/2\ U_i$

i.e., Total electrostatic energy of resulting system decreases by a factor of 2.



Question 24.

The resistance of a wire is 'R ohm. If it is melted and stretched to 'n' times its original length, its new resistance will be:-

[4 Marks]

(A) R/n^2

(B) nR

(C) n^2R

(D) R/n

Explanation:

We know that,

$R = \rho \ell / A$

or

$R = \rho \ell^2 / \text{Volume} \propto \ell^2$

According to question $\ell_2 = n\ell_1$

$R_2/R_1 = n^2\ell_1^2/\ell_1^2$

or,

$R_2/R_1 = n^2$

$\Rightarrow R_2 = n^2 R_1$

Question 25.

A potentiometer is an accurate and versatile device to make electrical measurements of E.M.F. because the method involves

[4 Marks]

(A) Cells

(B) A combination ofcells, galvanometer and resistances

(C) A condition of no current flow through the galvanometer

(D) Potential gradients

Explanation:

Reading of potentiometer is accurate because during taking reading it does not draw any current from the circuit .

Question 26.

A 250-turn rectangular coil of length 2.1 cm and width 1.25 cm can carry a current of 85 μA and subjected to magnetic field of strength 0.85 T. Work done for rotating the coil by 180° against the torque is

[4 Marks]

(A) 4.55 μJ

(B) 1.15 μJ

(C) 2.3 μJ

(D) 9.1 μJ

Explanation:

Work done,

$W = MB(\cos\theta_1 - \cos\theta_2)$

When it is rotated by angle 180°

$W = MB(\cos0° - \cos180°) = MB(1 + 1)$

$W = 2MIA$

$W = 2(NIA)\ B$

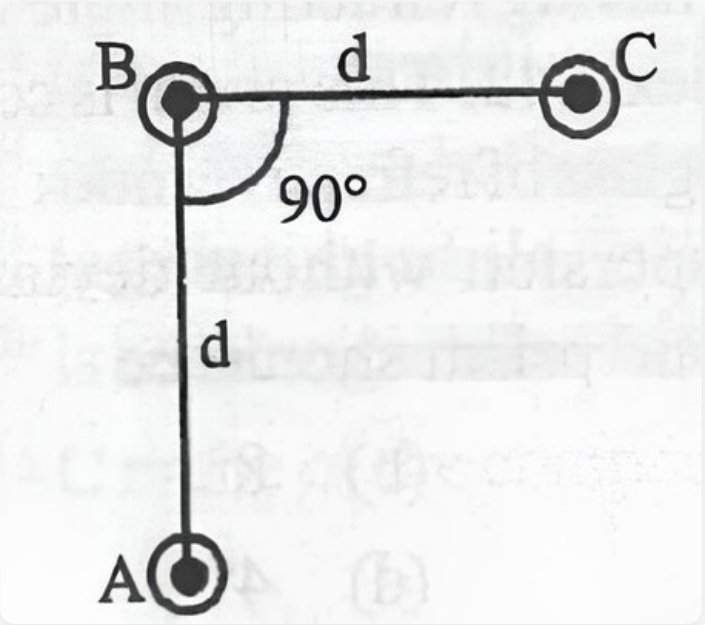
$= 2 \times 250 \times 85 \times 10^{-6}\ (1.25 \times 2.1 \times 10^{-4}) \times 85 \times 10^{-2}$

$\approx 9.1\ \mu J$

Question 27.

An arrangement of three parallel straight wires placed perpendicular to plane of paper carrying same current I along the same direction is shown in fig. Magnitude of force per unit length on the middle wire 'B' is given by

[4 Marks]



(A) $\mu_0 i^2/\sqrt{2}\pi d$

(B) $\mu_0 i^2/2\pi d$

(C) $\sqrt{2}\mu_0 i^2/\pi d$

(D) $2\mu_0 i^2/\pi d$

Explanation:

Force per unit length between two parallel current carrying conductors,

$F = \mu_0 i_1 i_2 / 2\pi d$

Since same current flowing through both the wires

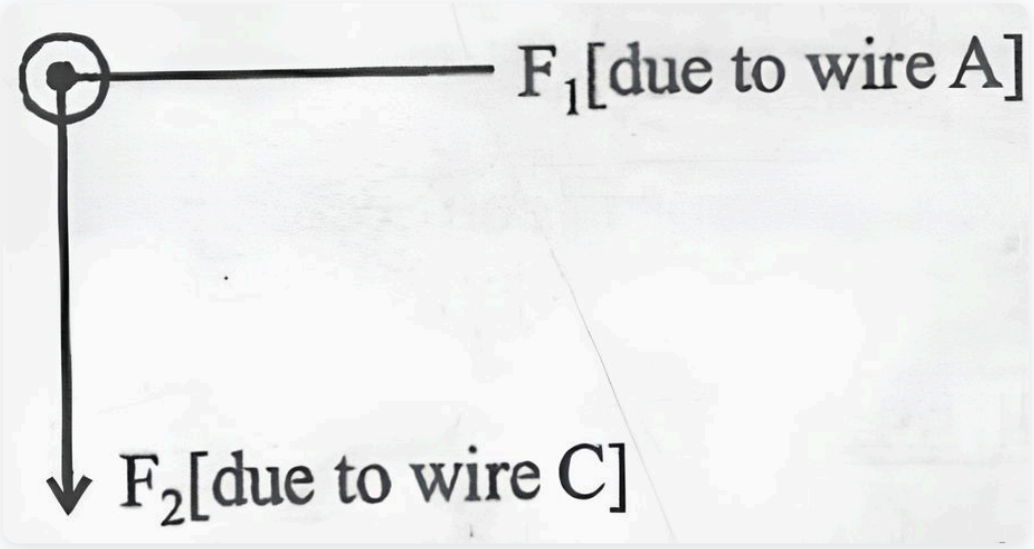
$i_1 = i_2 = i$

so $F_1 = \mu_0 i^2 / 2\pi d = F_2$

∴ Magnitude of force per unit length on the middle wire 'B'

$F_net = \sqrt{(F_1^2 + F_2^2)}$

$= \mu_0 i^2 / \sqrt{2\pi d}$



Question 28.

If θ_1 and θ_2 be the apparent angles of dip observed in two vertical planes at right angles to each other, then true angle of dip θ is given by :

[4 Marks]

(A) $\tan^2\theta = \tan^2\theta_1 + \tan^2\theta_2$

(B) $\cot^2\theta = \cot^2\theta_1 - \cot^2\theta_2$

(C) $\tan^2\theta = \tan^2\theta_1 - \tan^2\theta_2$

(D) $\cot^2\theta = \cot^2\theta_1 + \cot^2\theta_2$

Explanation:

If θ_1 and θ_2 are apparent angles of dip
Let α be the angle which one of the plane make with the magnetic meridian.
$\tan \theta_1 = V/(H \cos \alpha)$
i.e.,
$\cos \alpha = V/(H \tan \theta_1)$ ...(i)

$\tan \theta_2 = V/(H \sin \alpha)$

i.e.,

$\sin \alpha = V/(H \tan \theta_2)$ ...(ii)

Squaring and adding (i) and (ii), we get

$\cos^2 \alpha + \sin^2 \alpha = (V/H)^2 (1/\tan^2 \theta_1 + 1/\tan^2 \theta_2)$

i.e.,

$1 = V^2/H^2 [\cot^2 \theta_1 + \cot^2 \theta_2]$

or

$H^2/V^2 = \cot^2 \theta_1 + \cot^2 \theta_2$

i.e.,

$\cot^2 \theta = \cot^2 \theta_1 + \cot^2 \theta_2$

Question 29.

A long solenoid of diameter 0.1 m has 2×10^4 turns per meter. At the centre of the solenoid, a coil of 100 turns and radius 0.01 m is placed with its axis coinciding with the solenoid axis. The current in the solenoid reduces at a constant rate to OA from 4 A in 0.05 s. If the resistance of the coil is $10\pi^2\Omega$. the total charge flowing through the coil during this time is :

[4 Marks]

(A) 16πμC

(B) 32πμC

(C) 32μC

(D) 16μC

Explanation:

Given, no. of turns N = 100
radius, r = 0.01 m
resistance, $R = 10\pi^2\ \Omega$, $n = 2 \times 10^4$

As we know,

$\varepsilon = -N\, d\phi/dt$

$\Rightarrow \varepsilon/R = -N/R\, d\phi/dt$

$\Delta I = -N/R\, d\phi/dt$
$= \Delta q/\Delta t$

$= -N/R\, \Delta\phi/\Delta t$

$\Delta q = -[N/R(\Delta\phi/\Delta t)]\, \Delta t$

'−' ve sign shows that induced emf opposes the change of flux.

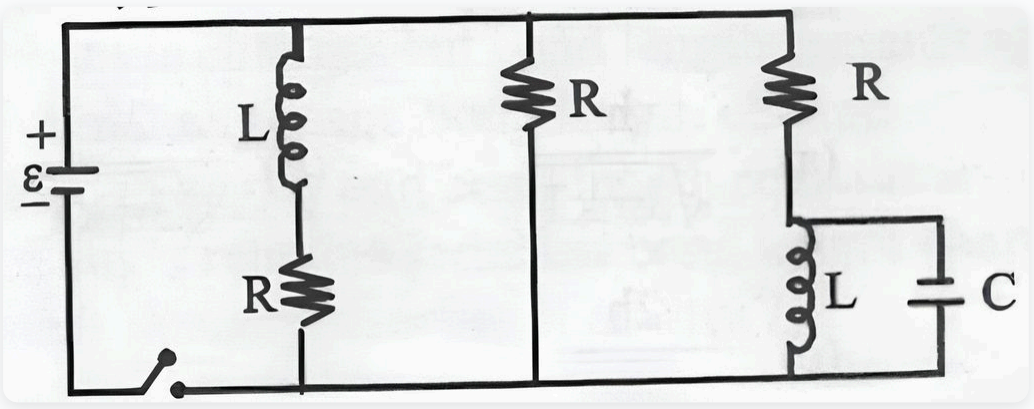
$\Delta q = [\mu_0 nN\pi r^2(\Delta i/\Delta t)]\, (1/R)\, \Delta t$
$= \mu_0 nN\pi r^2 \Delta i/R$

$\Delta q = (4\pi \times 10^{-7}) \times 100 \times 4 \times \pi \times (0.01)^2 \times 2 \times 10^4/$
$10\pi^2$
$\Delta q = 32\ \mu C$

Question 30.

Figure shows a circuit that contains three identical resistors with resistance R = 9.0 Ω each, two identical inductors with inductance L = 2.0 mH each, and an ideal battery with emf ε = 18 V. The current 'i' through the battery just after the switch closed is

[4 Marks]



(A) 2A

(B) 0.2A

(C) 2mA

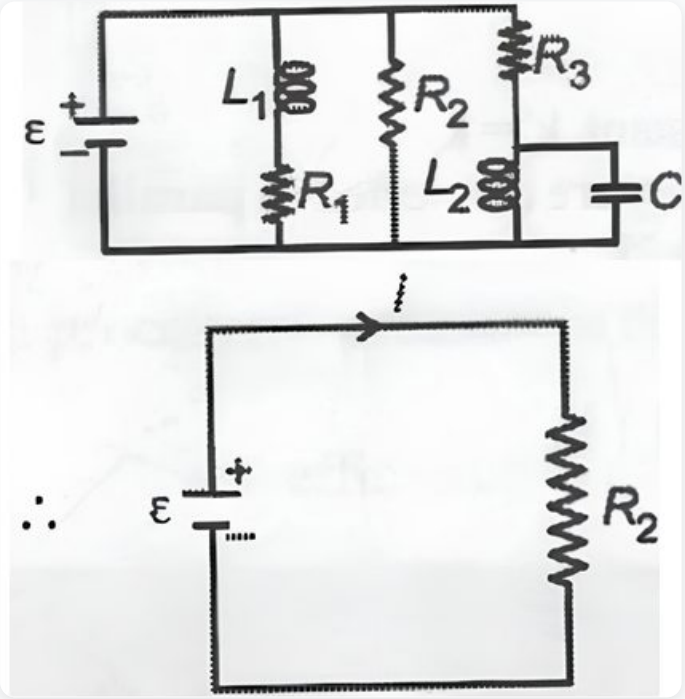
(D) 0

Explanation:

At t = 0, no current flows through R_1 and R_3.

Current through battery just after the switch closed is

$i = \varepsilon / R_2 = 18/9 = 2$ A



Question 31.

In an electromagnetic wave in free space the root mean square value of the electric field is $E_{ms} = 6$ V/m. The peak value of the magnetic field is

[4 Marks]

(A) 1.41×10^{-8} T

(B) 2.83×10^{-8} T

(C) 4.23×10^{-8} T

(D) 0.70×10^{-8} T

Explanation:

Given, $E_{ms} = 6$ V/m

$E_{ms}/B_{ms} = c$

$\Rightarrow B_{rms} = E_{rms}/c$ ...(i)

$B_{rms} = B_0/\sqrt{2} \Rightarrow B_0 = \sqrt{2}\, B_{rms}$

$B_0 = \sqrt{2} \times E_{rms}/c$ From equation (i)

$= \sqrt{2} \times 6/3 \times 10^8$

$= 2.83 \times 10^{-8}$ T

Question 32.

A beam of light from a source L is incident normally on a plane mirror fixed at a certain distance x from the source. The beam is reflected back and a spot on a scale placed just above the source I. When the mirror is rotated through a small angle θ, the spot of the light is found to move through a distance y on the scale. The angle θ is given by

[4 Marks]

(A) y/x

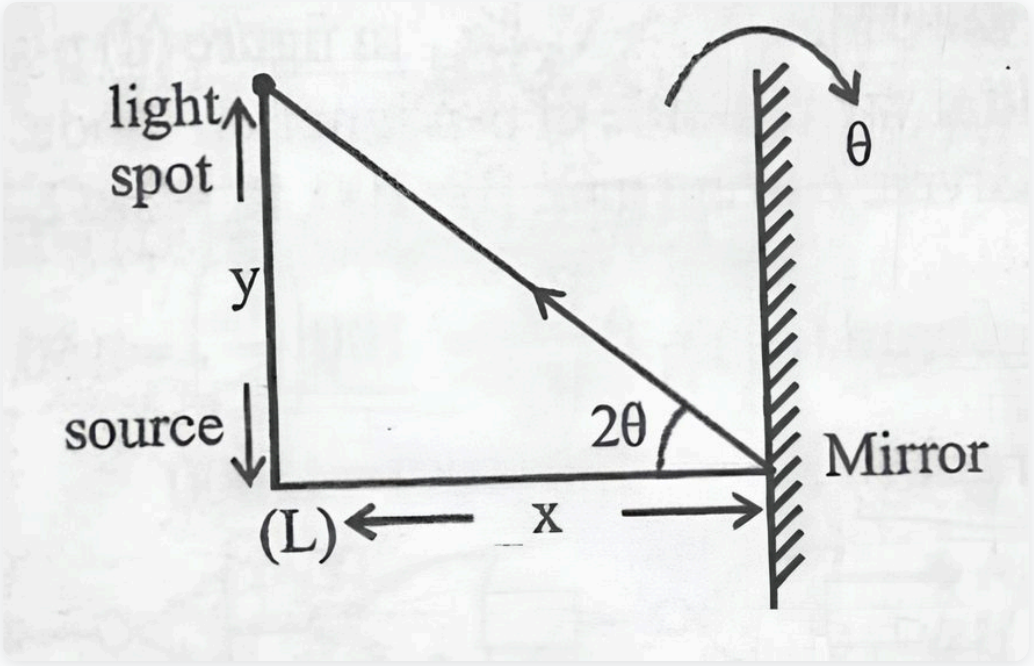
(B) x/2y

(C) x/y

(D) y /2x

Explanation:

When mirror is rotated by angle θ reflected ray will be rotated by 2θ.
According to the condition,
y/ x = 2θ
⇒ θ = y/2x



Question 33.

A thin prism having refracting angle 10° is made of glass of refractive index 1.42. This prism is combined with another thin prism of glass of refractive index 1.7. This combination produces dispersion without deviation. The refracting angle of second prism should be

[4 Marks]

(A) 10°

(B) 8°

(C) 6°

(D) 4°

Explanation:

For dispersion without deviation

$(\mu - 1)A_1 + (\mu' - 1)A_2 = 0$

$|(\mu - 1)A_1| = |(\mu' - 1)A_2|$

$(1.42 - 1) \times 10° = (1.7 - 1)A_2$

$4.2 = 0.7A_2$

$A_2 = 6°$

Question 34.

Young's double slit experiment is first performed in air and then in a medium other than air. It is found that 8th bright fringe is observed where 5th dark fringe lies in air. The refractive index of the medium is nearly

[4 Marks]

(A) 1.69

(B) 1.25

(C) 1.78

(D) 1.59

Explanation:

According to question

8^{Th} bright fringe in medium = 5^{Th} dark fringe in air

Y_{8th} bright = $8\ (\lambda D/\mu d)$

Y_{5th} dark = $(2 \times 5 - 1)\ \lambda D/2d = 9\lambda D/2d$

$\Rightarrow 9/2\ (\lambda D/d) = 8\ (\lambda D/\mu d)$

or, refractive index

$\mu = 16/9 = 1.78$

Question 35.

Two Polaroids P_1 and P_2 are placed with their axis perpendicular to each other. Unpolarized light I_0 is incident on P_1. A third polaroid P_3 is kept in between P_1 and P_2 such that its axis makes an angle 45° with that of P_1. The intensity of transmitted light P_2 is

[4 Marks]

(A) $I_0/16$

(B) $I_0/8$

(C) $I_0/4$

(D) $I_0/2$

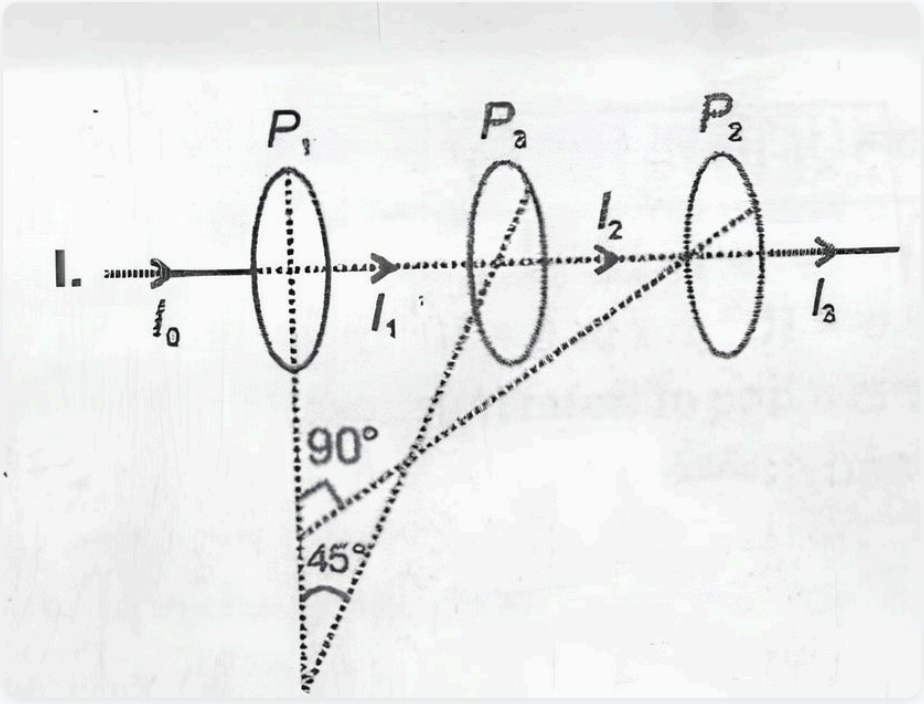
Explanation:

According to Malus law, $I = I_0\cos^2\theta$

$I_1 = I_0/2$

$I_2 = (I_0/2)\cos^2 45°$
$= (I_0/2) \times 1/2$
$= I_0/4$

$I_3 = (I_0/4)\cos^2 45°$
$= I_0/8$



Question 36.

The ratio of resolving powers of an optical microscope for two wavelengths $\lambda_1 = 4000$ Å and $\lambda_2 = 6000$ Å is

[4 Marks]

(A) 8 : 27

(B) 16 : 81

(C) 3 : 2

(D) 9 : 4

Explanation:

Resolving power of a microscope = $2\mu \sin \theta/\lambda$

i.e., $R \propto 1/\lambda$, or $R_1/R_2 = \lambda_2/\lambda_1$

Given that the two wavelengths,

$\lambda_1 = 4000$ Å and $\lambda_2 = 6000$ Å

$R_1/R_2 = 6000$ Å /4000 Å = 3/2

Question 37.

The de-Broglie wavelength of a neutron in thermal equilibrium with heavy water at a temperature T (Kelvin)

and mass m, is :-

[4 Marks]

(A) $2h/\sqrt{3mkT}$

(B) $h/\sqrt{mkT}$

(C) $2h/\sqrt{mkT}$

(D) $h/\sqrt{3mkT}$

Explanation:

We know that, de-Broglie wavelength $\lambda = h/\sqrt{(2mKE)}$
K.E. of thermal neutron = 3/2 kT
$\lambda = h/\sqrt{2m (3/2 kT)}$
$\lambda = h/\sqrt{3mkT}$

Question 38.

The ratio of wavelengths of the last line of Balmer series and the last line of Lyman series is

[4 Marks]

(A) 0.5

(B) 1

(C) 2

(D) 4

Explanation:

For last line of Balmer series:
$n_1 = 2$ and $n_2 = \infty$
$1/\lambda B = RZ^2 [1/n_1^2 - 1/n_2^2]$

$= R_1^2 [1/2^2 - 1/\infty^2]$
$1/\lambda_B = 4/R \quad ...(i)$

For last line of Lyman series:
$n_1 = 1$ and $n_2 = \infty$
$1/\lambda_L = RZ^2 [1/n_1^2 - 1/n_2^2]$
$= RZ^2 [1/1^2 - 1/\infty^2]$

$\lambda_L = 1/R \quad ...(ii)$
Dividing equation (i) by (ii)
$\lambda_B/\lambda_L = (4/R)/(1/R)$
Ratio of wavelengths is
$\lambda_B/\lambda_ = 4$

Question 39.

Radioactive material 'A' has decay constant λ and material 'B' has decay constant λ'. Initially they have same number of nuclei. After what time, the ratio of number of nuclei of material 'B' to that 'A' will be 1/e?

[4 Marks]

(A) 1/λ

(B) 1/9λ

(C) 1/8λ

(D) 1/7λ

Explanation:

Given, $\lambda_A = 8\lambda, \lambda_B = \lambda$

$$N_B = \frac{N_A}{e}$$

$$\Rightarrow \quad N_0 e^{-\lambda_B t} = N_0 \frac{e^{-\lambda_A t}}{e}$$

$$e^{-\lambda t} = e^{-8\lambda t} e^{-1}$$

$$e^{-\lambda t} = e^{-8\lambda t - 1}$$

Comparing both side powers

$$-\lambda t = -8\lambda t - 1$$

$$-1 = 7\lambda t$$

$$t = -\frac{1}{7\lambda}$$

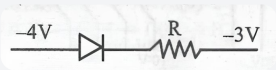
The best possible answer is $t = \frac{1}{7\lambda}$

Question 40.

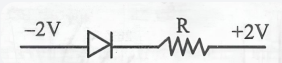
Which one of the following represents forward bias diode?

[4 Marks]

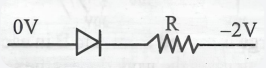
(A)



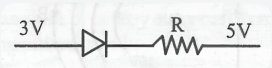
(B)



(C)



(D)



Explanation:

In forward bias, $V_1 > V_2$ i.e., in figure (d) p-side is at higher potential w.r.t. n-side of p-n junction diode.



Question 41.

In a common emitter transistor amplifier the audio signal voltage across the collector is 3 V. The resistance of collector is 3 kΩ. If current gain is 100 and the base resistance is 2 kΩ, the voltage and power gain of the amplifier is

[4 Marks]

(A) 200 and 1000

(B) 20 and 2000

(C) 15 and 200

(D) 150 and 15000

Explanation:

Given, current gain β = 100, R_C = 3kΩ, R_b = 2kΩ

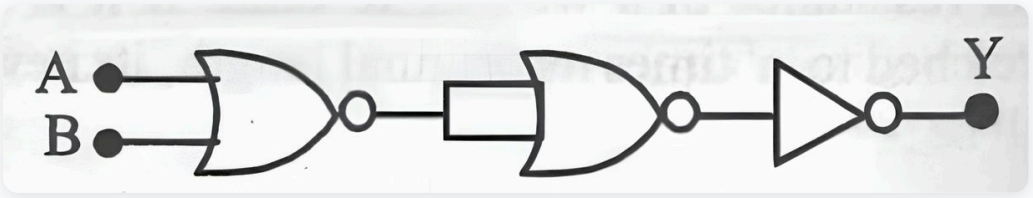
Voltage gain (A_v) = β R_C/R_b = 100 (3/2) = 150

Power gain = A_v β = 150 × 100 = 15000

Question 42.

The given electrical network is equivalent to :

[4 Marks]



(A) NOT gate

(B) AND gate

(C) OR gate

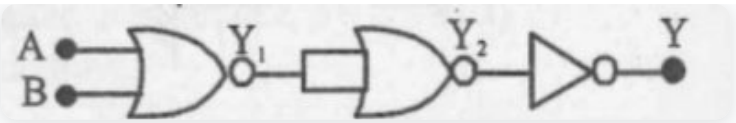
(D) NOR gate

Explanation:

$Y_1 = \overline{A} + \overline{B}$

$Y_2 = Y_1 + \overline{Y}_1 = \overline{Y}_1 = A + B$

$Y = \overline{Y}_2 = \overline{A} + \overline{B}$ i.e. NOR gate.



Question 43.

Which one is the wrong statement ?

[4 Marks]

(A) de-Broglie's wavelength is given by $\lambda = h/mv$ where m = mass of the particle, v = group velocity of the particle.

(B) The energy of 2s orbital is less than the energy of 2p orbital in case of Hydrogen like atoms.

(C) The uncertainty principle is $\Delta E \times \Delta t \geq h/4\pi$

(D) Half filled and fully filled orbitals have greater stability due to greater exchange energy, greater symmetry and more balanced arrangement.

Explanation:

For hydrogen like atoms energy of 2s orbital and 2p-orbital is equal.

Question 44.

The element Z = 114 has been discovered recently.
It will belong to which of the following family/group and electronic configuration?

[4 Marks]

(A) Halogen family, $[Rn]\ 5f^{14}\ 6d^{10}\ 7s^2\ 7p^5$

(B) Nitrogen family, $[Rn]\ 5f^{14}\ 6d^{10}\ 7s^2\ 7p^6$

(C) Carbon family, $[Rn]\ 5f^{14}\ 6d^{10}\ 7s^2\ 7p^2$

(D) Oxygen family, $[Rn]\ 5f^{14}\ 6d^{10}\ 7s^2\ 7p^4$

Explanation:

After $_{86}Rn$ (Group 18), elements from atomic number 89 to 103 (actinoids) are in group 3 114 = 103 + 11. Thus, element with atomic number 114 will be in group (3 + 11) or group 14 (carbon family).

The outer shell configuration of group 14 is ns^2np^2.

Hence, only option (a) is correct.

Question 45.

Which of the following pairs of compounds isoelectronic and isostructural?

[4 Marks]

(A) $BeCl_2$, XeF_2

(B) TeI_2, XeF_2

(C) IF_3, XeF_2

(D) IBr_2^-, XeF_2

Explanation:

IBr_2^-, XeF_2
Total number of valence electrons are equal in both the species and both the species exhibit linear shape.

Question 46.

The species, having bond angles of 120° is:

[4 Marks]

(A) PH_3

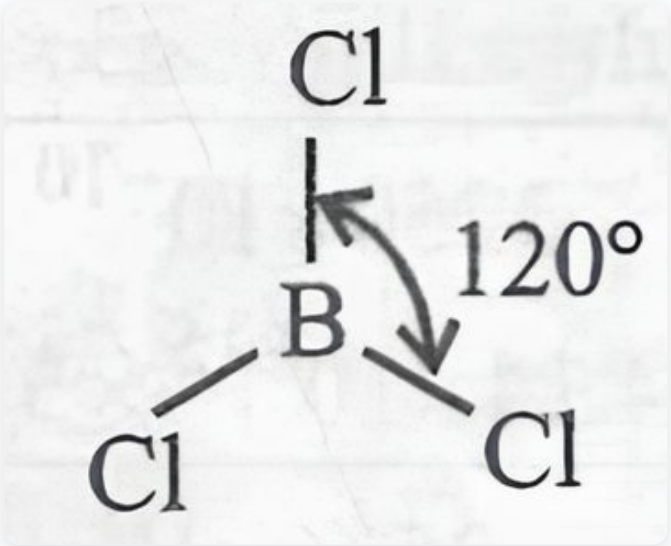
(B) NCl_3

(C) ClF_3

(D) BCl_3

Explanation:

BCl_3 is trigonal planar and hence the bond angle is 120°.



Question 47.

Which of the following pairs of species have the same bond order?

[4 Marks]

(A) CN^-, CO

(B) O_2, NO^+

(C) CO, NO

(D) N_2, O^{-}_2

Explanation:

CN^- and CO have same no. of electrons and have same bond order equal to 3.

Question 48.

A gas is allowed to expand in a well insulated container against a constant external pressure of 2.5 atm from an initial volume of 2.50 L to a final volume of 4.50 L. The change in internal energy ΔU of the gas in joules will be:

[4 Marks]

(A) −500 J

(B) +505 J

(C) 1136.25 J

(D) −505 J

Explanation:

The system is in isolated state.

∴ For an adiabatic process, q = 0

$\Delta U = q + w$

∴ $\Delta U = w$

$= -P\Delta V$

$= -2.5 \text{ atm} \times (4.5 - 2.5) \text{ L}$

$= -2.5 \times 2 \text{ L-atm.}$

$= -5 \times 101.3 \text{ J}$

$= -506.5 \text{ J} \approx -505 \text{ J}$

Question 49.

For a given reaction, $\Delta H = 35.5 \text{ kJ mol}^{-1}$ and $\Delta S = 83.6 \text{ JK}^{-1} \text{ mol}^{-1}$. The reaction is spontaneous at:

(Assume that ΔH and ΔS do not vary with temperature)

[4 Marks]

(A) T > 425 K

(B) All temperatures

(C) T > 298 K

(D) T < 425 K

Explanation:

Given $\Delta H = 35.5\ kJ\ mol^{-1}$
$\Delta S = 83.6\ J\ K^{-1}\ mol^{-1}$
$\therefore \Delta G = \Delta H - T\Delta S$
For a reaction to be spontaneous, ΔG = −ve
i.e., $\Delta H < T\Delta S$

$\because T > \Delta H / \Delta S = 35.5*10^3\ Jmol^{-1}/83.6Jk^{-1}$

So, the given reaction will be spontaneous at
T > 425 K

Question 50.

The equilibrium constant of the following are:

$N_2 + 3H_2 \rightleftharpoons 2NH_3\ K_1$
$N_2 + O_2 \rightleftharpoons 2NO\ K_2$

$H_2 + 1/2\ O_2 \rightleftharpoons H_2O\ K_3$

[4 Marks]

The equilibrium constant (K) of the reaction :
$2NH_3 + \frac{5}{2}O_2 \overset{K}{\rightleftharpoons} 2NO + 3H_2O$, will be;

(A) $K_2^3K_3/K_1$

(B) $K_2K_3^3/K_1$

(C) $K_1K_3^3/K_2$

(D) K_2K_3/K_1

Explanation:

(i) $N_2 + 3H_2 \rightleftharpoons 2NH_3; K_1 = \frac{[NH_3]^2}{[N_2][H_2]^3}$

(ii) $N_2 + O_2 \rightleftharpoons 2NO; K_2 = \frac{[NO]^2}{[N_2][O_2]}$

(iii) $H_2 + \frac{1}{2}O_2 \longrightarrow H_2O; K_3 = \frac{[H_2O]}{[H_2][O_2]^{1/2}}$

Applying (II + 3 × III – I) we will get

$$2NH_3 + \frac{5}{2}O_2 \overset{K}{\rightleftharpoons} 2NO + 3H_2O;$$

$$K = \frac{[NO]^2}{[N_2][O_2]} \times \frac{[H_2O]^3}{[H_2]^3 \times [O_2]^{3/2}} \Big/ \frac{[NH_3]^2}{[N_2][H_2]^3}$$

$\therefore \quad K = K_2 \times K_3^3 / K_1$

Question 51.

A 20 litre container at 400 K contains CO_2(g) at pressure 0.4 atm and excess of SrO (neglect volume occupied by SrO). The volume of the container is now decreased by moving the movable piston tighter, with constant temperature. The maximum volume of the container, when pressure of CO_2 attains its maximum value, will be: (Given that : $SrCO_3$(s) ⇌ SrO(s) + CO_2(g), KP = 1.6 atm)

[4 Marks]

(A) 5 litre

(B) 2 litre

(C) 4 litre

(D) 10 litre

Explanation:

Max. pressure of CO_2 = Pressure of CO_2 at equilibrium

$SrCO_3(s) \rightleftharpoons SrO(s) + CO_2(g)$

$K_p = P_{CO_2} = 1.6$ atm = maximum pressure of CO_2.

volume of container at this stage,

$V = nRT/P$ ...(i)

Since container is sealed and reaction was not earlier at equilibrium,

$n = PV/RT = (0.4 \times 20)/(RT)$ ...(ii)

Put equation (ii) in equation (i)

$V = [(0.4 \times 20)/(RT)]RT / 1.6$

$V = 5$ L

Question 52.

Concentration of the Ag^+ ions in a saturated solution of $Ag_2C_2O_4$ is 2.2×10^{-4} mol L^{-1}. Solubility product of $Ag_2C_2O_4$ is:

[4 Marks]

(A) 2.66×10^{-12}

(B) 2.42×10^{-8}

(C) 4.5×10^{-11}

(D) 5.3×10^{-12}

Explanation:

$$Ag_2C_2O_4(s) \rightleftharpoons \underset{2s}{2Ag^+(aq)} + \underset{s}{C_2O_4^{2-}(aq)}$$

$$K_{sp} = [Ag^+]^2 [C_2O_4^{2-}]$$

$$[Ag^+] = 2.2 \times 10^{-4} M$$

Given that:

$\therefore$ Concentration of $C_2O_4^{2-}$ ions,

$$[C_2O_4^{2-}] = \frac{2.2 \times 10^{-4}}{2} M = 1.1 \times 10^{-4} M$$

$$\therefore \quad K_{sp} = (2.2 \times 10^{-4})^2 (1.1 \times 10^{-4})$$

$$= 5.324 \times 10^{-12}$$

Question 53.

It is because of inability of np^2 electrons of the valence shell to participate in bonding that:

[4 Marks]

(A) Sn^{4+} is reducing while Pb^{4+} is oxidising

(B) Sn^{2+} is oxidising while Pb^{4+} is reducing

(C) Sn^{2+} and Pb^{2+} are both oxidising and reducing

(D) Sn^{2+} is reducing while Pb^{4+} is oxidising

Explanation:

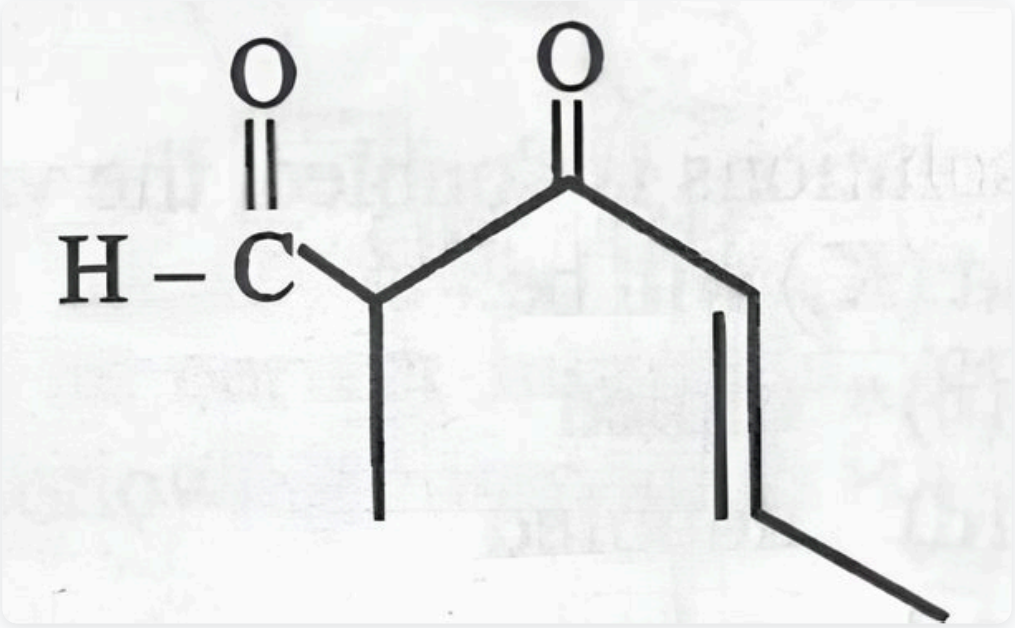
Due to inert pair effect, Pb(II) is more stable than Pb(IV).
Sn(IV) is more stable than Sn(II).

Pb(IV) is easily reduced to Pb(II) and can acts as an oxidising agent whereas Sn(II) is easily oxidised to Sn(IV) and can acts as a reducing agent.

Question 54.

The IUPAC name of the compound is:

[4 Marks]



(A) 3-keto-2-methylhex-4-enal

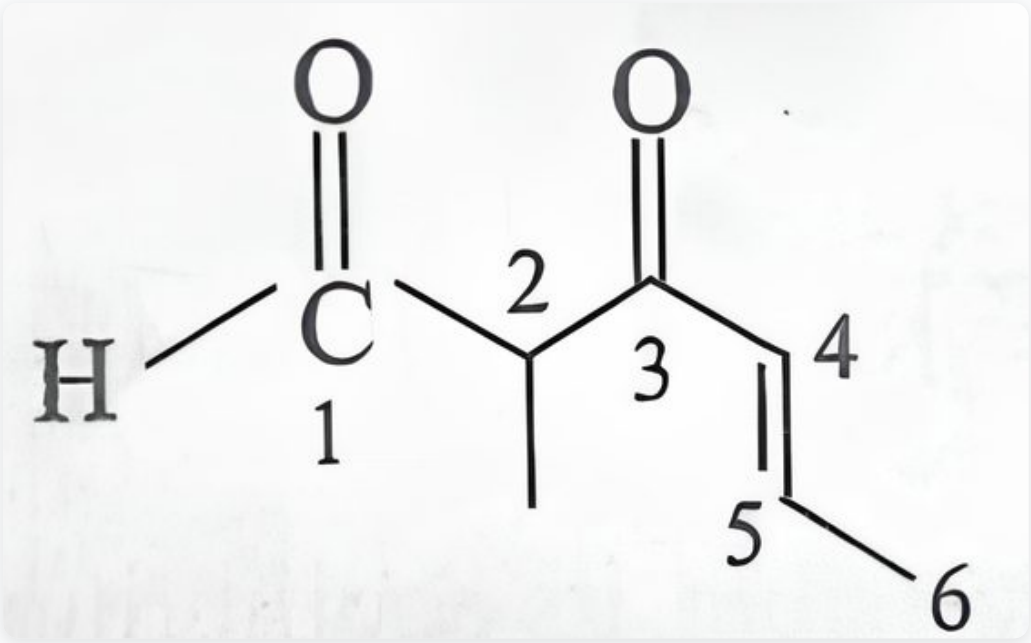
(B) 3-keto-2-methylhex-5-enal

(C) 5-methyl-4-oxohex-2-en-5-al

(D) 5-formylhex-2-en-3-one

Explanation:

3-keto-2-methylhex-4-enal
Aldehydes get higher priority over ketone and alkene in numbering of principal carbon chain.



Question 55.

The most suitable method of separation of 1 : 1 mixture of ortho and para-nitrophenols is:

[4 Marks]

(A) Sublimation

(B) Steam distillation

(C) Crystallisation

(D) Chromatography

Explanation:

The o-isomer is steam volatile due to intra-molecular H-bonding. The p-isomer is not steam volatile due to intermolecular H-bonding or association of molecules.

Thus, both can be separated by steam distillation.

Question 56.

The correct statement regarding electrophile is:

[4 Marks]

(A) Electrophile is a negatively charged species and can form a bond by accepting a pair of electrons from another electrophile

(B) Electrophiles are generally neutral species and can form a bond by accepting pair of electrons from a nucleophile

(C) Electrophile is a negatively charged species and can form a bond by accepting a pair of electrons from a nucleophile

(D) Electrophile can be either neutral or positively charged species and can form a bond by accepting a pair of electrons from a nucleophile

Explanation:

Electrophile is a electron deficient species and can accept pair of electrons from nucleophile.

Question 57.

With respect to the conformers of ethane, which of the following statements is true?

[4 Marks]

(A) Bond angle remains same but bond length changes

(B) Both bond angles and bond length remains same

(C) Both bond angle and bond length change

(D) Bond angle changes but bond length remains same

Explanation:

There is no change in bond angles and bond lengths in the conformation of ethane.

Question 58.

Which one is the correct order of acidity?

[4 Marks]

(A) CH_3-CH_3>CH_2=CH_2>CH_3–C≡CH>CH≡CH

(B) CH≡CH>CH_2=CH_2>CH_3–C≡CH>CH_3–CH_3

(C) CH≡CH > CH_3–C≡CH > CH_2=CH_2 > CH_3–CH_3

(D) CH_2=CH_2>CH_3-CH=CH–>CH_3-c ≡CH>CH≡CH

Explanation:

Correct order is

H-C≡C -H > H_3c – C ≡ C-H > H_2c
(Two acidine hydrogensc) (One acidichydrogen)

= CH_2> CH_3 - CH_3

Question 59.

Which of the following is a sink for CO?

[4 Marks]

(A) Oceans

(B) Haemoglobin

(C) Plants

(D) Microorganism present in the soil

Explanation:

Microorganisms present in the soil is a sink for CO.

Question 60.

If molality of the dilute solutions is doubled, the value of molal depression constant (K_f) will be-

[4 Marks]

(A) tripled

(B) halved

(C) unchanged

(D) doubled

Explanation:

K_f (molal depression constant) only depends on the nature of the solvent and is independent of the Concentration of the solution.

Question 61.

Which of the following is dependent on temperature?

[4 Marks]

(A) Molality

(B) Weight percentage

(C) Mole fraction

(D) Molarity

Explanation:

Molarity depends on the volume of a solution which can be changed with change in temperature.

Question 62.

Ionic mobility of which of the following alkali metal ions is lowest when aqueous solution of their salts are put under an electric field?

[4 Marks]

(A) K

(B) Li

(C) Rb

(D) Na

Explanation:

Li^+ being smallest, has maximum charge density.
∴ Li^+ is most heavily hydrated among all alkali metal ions. Effective size of Li^+ in aqueous solution is therefore, largest. So, moves slowest under electric field.

Question 63.

In the electrochemical cell:-
Zn | $ZnSO_4$ (0.01 M) || $CuSO_4$ (1.0 M) | Cu, the emf of this Daniell cell is E_1. When the concentration of $ZnSO_4$ is

changed to 1.0 M and that of $CuSO_4$ changed to 0.01 M, the emf changes to E_2. From the following, which one is the relationship between E_1 and E_2? (Given, RT/F = 0.059)

[4 Marks]

(A) $E_1 < E_2$

(B) $E_1 > E_2$

(C) $E_1 = E_2$

(D) $E_2 = 0 \neq E_1$

Explanation:

For cell,
$Zn \mid ZnSO_4$ (0.01 M) || $CuSO_4$ (1.0 M) | Cu

$E_{cell} = E°_{cell} - (2.303RT/ /nF \log ([Zn^{2+}] / [Cu^{2+}]$

$\therefore E_1 = E°_{cell} - (2.303RT/2F)$ *log(0.01/0.1)*

When concentrations are changed for $ZnSO_4$ and $CuSO_4$, we can write

$E_2 = E°_{cell} - (2.303RT/2F) * \log(1/0.01)$

$\therefore E_1 > E_2$

Question 64.

Mechanism of a hypothetical reaction
$X_2 + Y_2 \rightarrow 2XY$ is given below:

(i) $X_2 \rightarrow X + X$ (fast)
(ii) $X + Y_2 \rightleftharpoons XY + Y$ (slow)
(iii) $X + Y \rightarrow XY$ (fast)
The overall order of the reaction will be:

[4 Marks]

(A) 1.5

(B) 1

(C) 2

(D) 0

Explanation:

Overall rate = $k[X][Y_2]$ ...(1)
k = rate constant

Assuming step (i) to be reversible, its equilibrium constant,
k(eq)subscript = $[X]^2/[X_2]$
$\Rightarrow [X]^2$ = k(eq)subscript $[X_2]$
$\Rightarrow [X]$ = k(eq)subscript $\frac{1}{2}[X_2]^{\frac{1}{2}}$ ...(2)
From (eq)subscript (1) and (2)
Rate = kk(eq)subscript $\frac{1}{2}[X_2]^{\frac{1}{2}}[Y_2]$
Overall order = 1/2 + 1 = 3/2 = 1.5

Question 65.

A first order reaction has a specific reaction rate of 10^{-2} s^{-1}. How much time will it take for 20 g of the reactant to reduce to 5 g?

[4 Marks]

(A) 138.6 sec

(B) 346.5 sec

(C) 693.0 sec

(D) 238.6 sec

Explanation:

Half life for a first order reaction,
$t_{1/2}$ = 0.693/K
So,
$t_{1/2}$ = $0.693/10^{-2}$ sec
Also, for the reduction of 20 g of reactant to 5 g, two half lives will be required.
∴ For 20 g of the reactant to reduce to 5 g, time taken,
t = 2 × $(0.693/10^{-2})$ sec = 138.6 sec.

Question 66.

Which one of the following statements is not correct?

[4 Marks]

(A) The value of equilibrium constant is changed in the presence of a catalyst in the reaction at equilibrium

(B) Enzymes catalyse mainly bio-chemical reactions

(C) Catalyst does not initiate any reaction

(D) Coenzymes increase the catalytic activity of enzyme

Explanation:

A catalyst speeds up both forward and backward reaction with the same rate.
So, equilibrium constant is not affected by the presence of a catalyst at any given temperature.

Question 67.

Extraction of gold and silver involves leaching with CN^- ion. Silver is later recovered by

[4 Marks]

(A) distillation

(B) zone refining

(C) displacement with Zn

(D) liquation

Explanation:

Zn being more reactive than Ag and Au, displaces them.

Question 68.

In which pair of ions both the species contain S–S bond?

[4 Marks]

(A) $S_4O_6^{2-}$, $S_2O_7^{2-}$

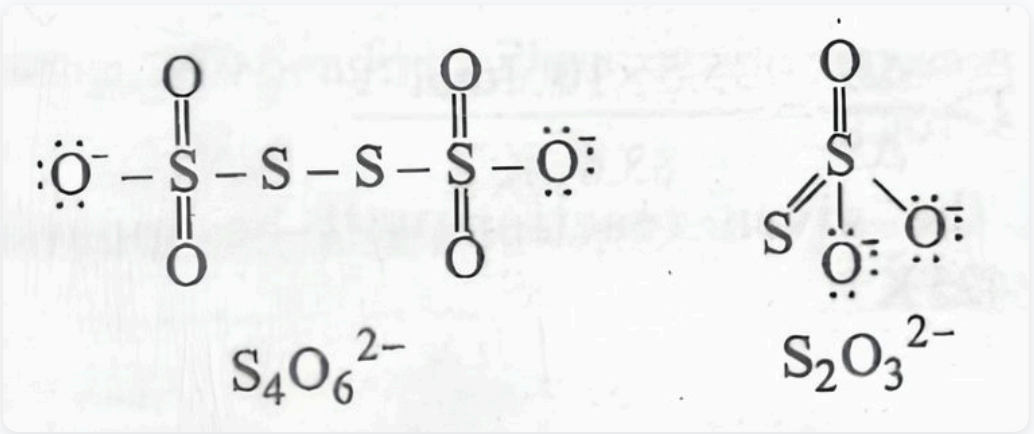
(B) $S_2O_7^{2-}$, $S_2O_8^{2-}$

(C) $S_4O_6^{2-}$, $S_2O_3^{2-}$

(D) $S_2O_7^{2-}$, $S_2O_3^{2-}$

Explanation:

Zn being more reactive than Ag and Au, displaces them.



Question 69.

Name the gas that can readily decolourise acidified $KMnO_4$ solution :

[4 Marks]

(A) NO_2

(B) CO_2

(C) SO_2

(D) P_2O_5

Explanation:

Potassium permanganate has a purple colour. When sulphur dioxide reacts with potassium permanganate, the solution decolourises.

$5SO_2 + 2KMnO_4 + 2H_2O \rightarrow 2H_2SO_4 + 2MnSO_4 + K_2SO_4$

Question 70.

The reason for greater range of oxidation states in actinoids is attributed to :

[4 Marks]

(A) actinoid contraction

(B) 5f, 6d and 7s levels having comparable energies

(C) 4f and 5d levels being close in energies

(D) the radioactive nature of actinoids

Explanation:

Minimum comparable energy gap between 5f, 6d and 7s subshell makes electron excitation easier, hence there is a greater range of oxidation states in actinoids.

Question 71.

The correct order of the stoichiometries of AgCl formed when $AgNO_3$ in excess is treated with the complexes $CoCl_3 \cdot 6NH_3$, $CoCl_3 \cdot 5NH_3$, $CoCl_3 \cdot 4NH_3$ respectively is :

[4 Marks]

(A) 3AgCl, 1AgCl, 2AgCl

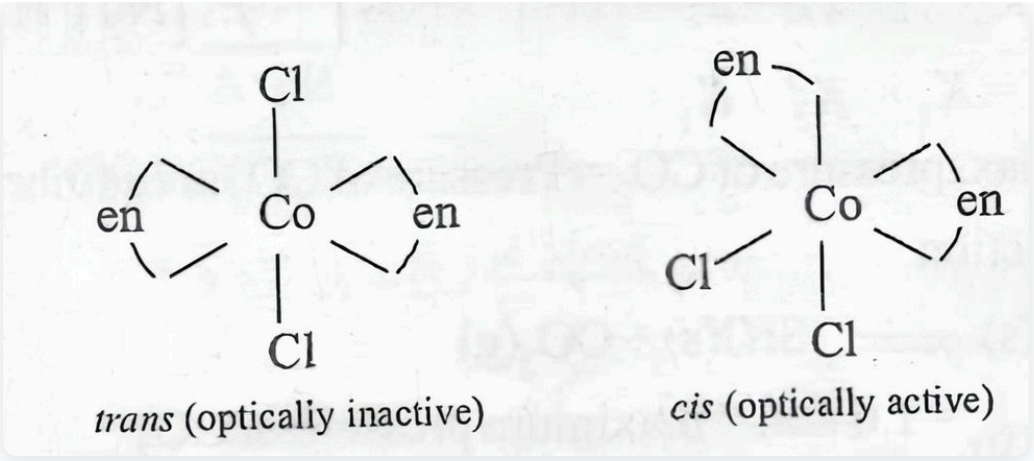
(B) 3AgCl, 2AgCl, 1AgCl

(C) 2AgCl, 3AgCl ,1AgCl,

(D) 1AgCl, 3AgCl, 2AgCl

Explanation:

In the given complex, the CN of Co is 6, and the complex has octahedral geometry.



Question 72.

$HgCl_2$ and I_2 both when dissolved in water containing I^- ions, the pair of species formed is :

[4 Marks]

(A) HgI_4^{2-}, I_3^-

(B) HgI_2, I^-

(C) HgI_2, I_3^-

(D) Hg_2I_2, I^-

Explanation:

In a solution containing $HgCl_2$, I_2 and I^-, both $HgCl_2$ and I_2 compete for I^-.

Since formation constant of $[HgI_4]^{2-}$ is very large (1.9×10^{30}) as compared with I_3^- (Kf = 700).

$\therefore$ I^- will preferentially combine with $HgCl_2$.

$HgCl_2 + 2I^- \rightarrow HgI_2$ (*Red ppt*) $\downarrow + 2Cl^-$

$HgI_2 + 2I^- \rightarrow [HgI_4]^{2-}$ *soluble*

Question 73.

Correct increasing order for the wavelengths of absorption in the visible region the complexes of Co^{3+} is :-

[4 Marks]

(A) $[Co(en)_3]^{3+}$, $[Co(NH_3)_6]^{3+}$, $[Co(H_2O)_6]^{3+}$

(B) $[Co(NH_3)_6]^{3+}$, $[Co(en)_3]^{3+}$, $[Co(H_2O)_6]^{3+}$

(C) $[Co(H_2O)_6]^{3+}$, $[Co(en)_3]^{3+}$, $[Co(NH_3)_6]^{3+}$

(D) $[Co(H_2O)_6]^{3+}$, $[Co(NH_3)_6]^{3+}$, $[Co(en)_3]^{3+}$

Explanation:

The order of strength of ligand is

en > NH_3 > H_2O

For stronger ligand, the value of Δ_0 for the complex is higher.

Hence, the increasing order of wavelengths of absorption is:

$[Co(en)_3]^{3+} < [Co(NH_3)_6]^{3+} < [Co(H_2O)_6]^{3+}$

Question 74.

Pick out the correct statement with respect to $[Mn(CN)_6]^{3-}$:-

[4 Marks]

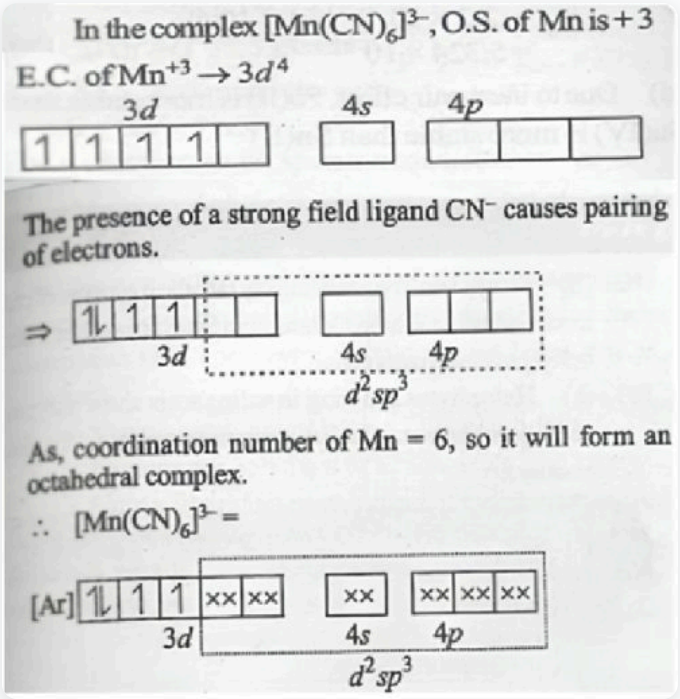
(A) It is sp^3d^2 hybridised and tetrahedral

(B) It is sp^3d^2 hybridised and octahedral

(C) It is d^2sp^3 hybridised and octahedral

(D) It is dsp^2 hybridised and square planar

Explanation:



Question 75.

An example of sigma bonded organometallic compound is :

[4 Marks]

(A) Ruthenocene

(B) Cobaltocene

(C) Ferrocene

(D) Grignard's reagent

Explanation:

Grignard's reagent (RMgX) is a σ-bonded organometallic compound.

Question 76.

Which one is the most acidic compound ?

[4 Marks]

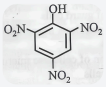
(A)



(B)



(C)



(D)



Explanation:

Electron withdrawing $–NO_2$ group has very strong –I and –R effects so, compound 3 will be most acidic

Question 77.

The heating of phenyl-methyl ethers with HI produces

[4 Marks]

(A) Iodobenzene

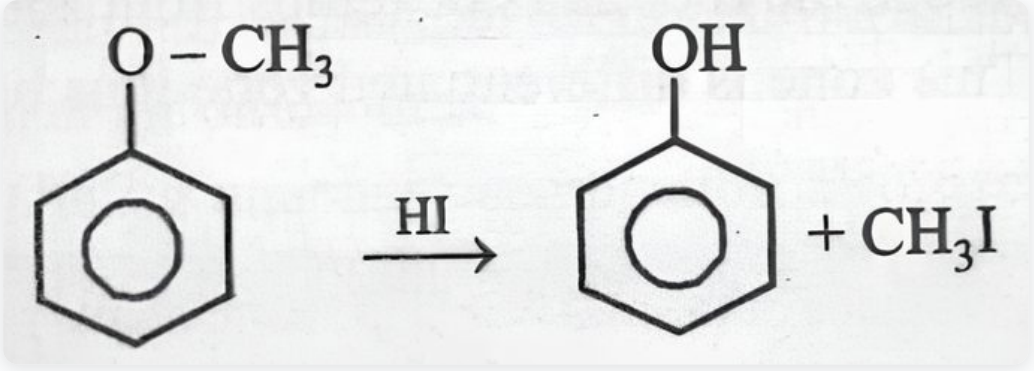
(B) Phenol

(C) Benzene

(D) Ethyl chlorides

Explanation:

When Ar–O–R ethers are reacted with HI, they are cleaved at weaker O–R bond to give phenol and alkyl iodide.

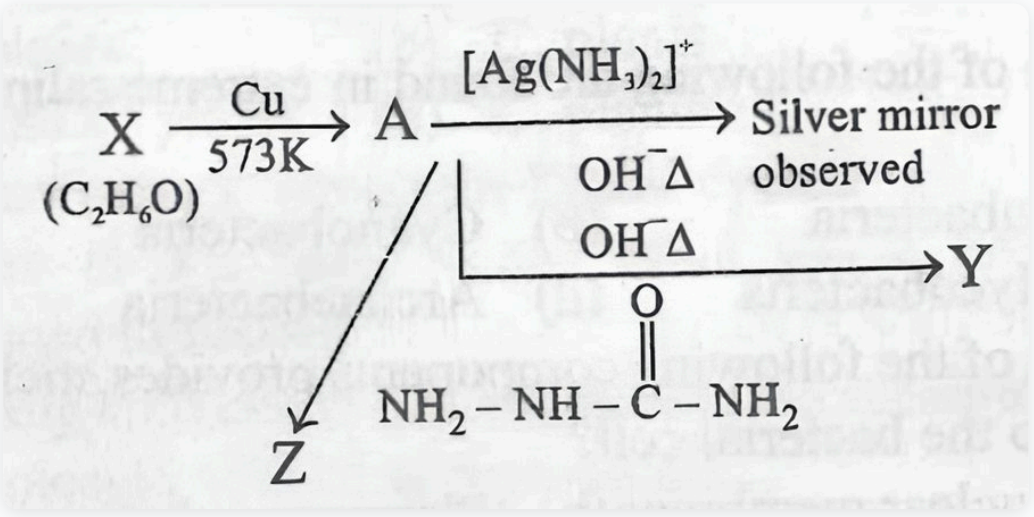


Question 78.

Consider the reactions :-

Identify A, X, Y and Z

[4 Marks]



(A) A–Methoxymethane, X–Ethanoic acid, Y–Acetate ion, Z–Hydrazine.

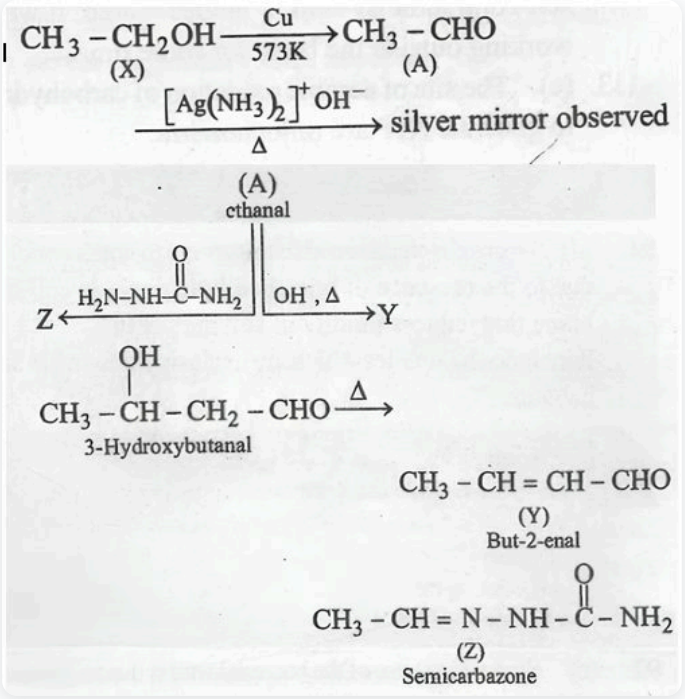
(B) A–Ethanal, X–Ethanol, Y–But-2-enal, Z–Semicarbazone.

(C) A–Ethanol, X–Acetaldehyde, Y–Butanone, Z–Hydrazone.

(D) A–Methoxymethane, X–Ethanol, Y–Ethanoic acid, Z–Semicarbazide.

Explanation:

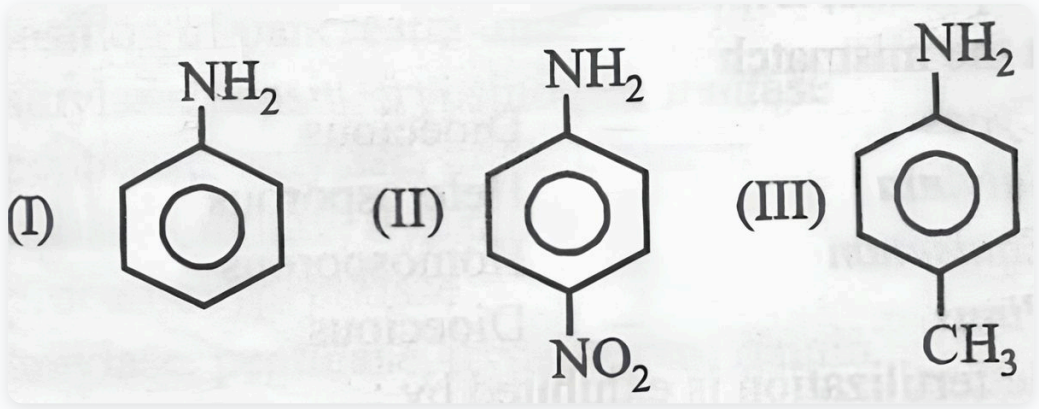
Since 'A' gives positive silver mirror test therefore, it must be an aldehyde or α-Hydroxyketone. Also, reaction with OH^- i.e., aldol condensation (by assuming alkali to be dilute) indicates that 'A' is aldehyde as aldol reaction of ketone is reversible and carried out in special apparatus. It indicates that 'A' is an aldehyde.



Question 79.

The correct increasing order of basic strength for the following compounds is :

[4 Marks]



(A) III

(B) III

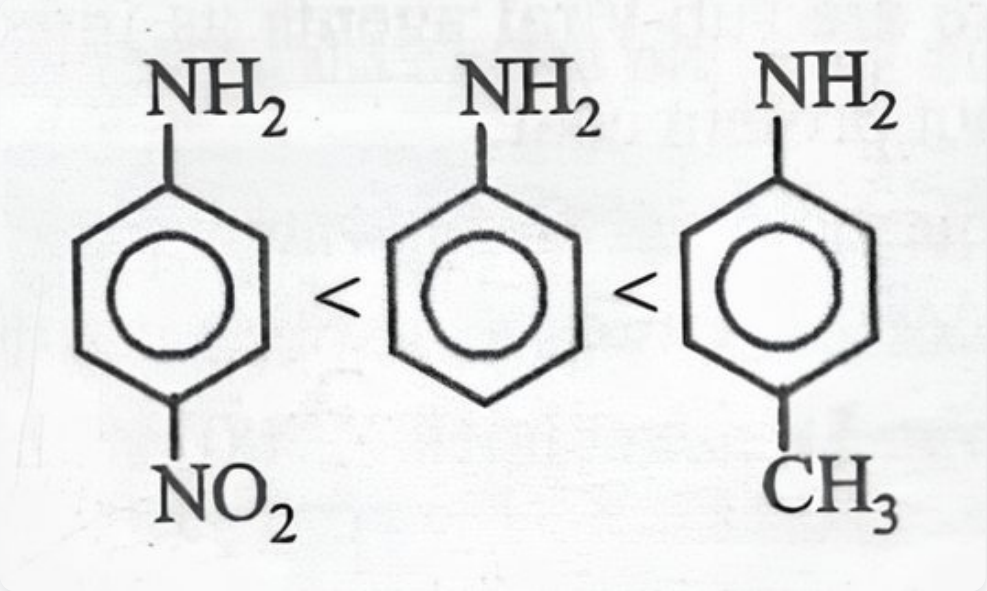
(C) II

(D) II

Explanation:

$-NO_2$ group has strong –R effect and $-CH_3$ shows +R effect.

∴ Order of basic strength is



Question 80.

Which of the following reactions is appropriate for converting acetamide to methanamine?

[4 Marks]

(A) Gabriel's phthalimide synthesis

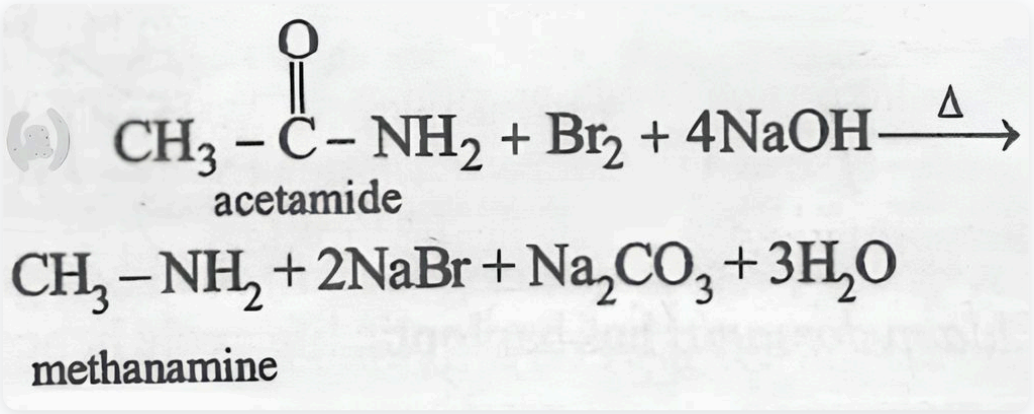
(B) Carbylamine reaction

(C) Stephens reaction

(D) Hoffmann hypobromamide reaction

Explanation:

It is called **Hoffmann Bromamide reaction**.



Question 81.

Which of the following statements is not correct :

[4 Marks]

(A) Ovalbumin is a simple food reserve in egg-white

(B) Blood proteins thrombin and fibrinogen are involved in blood clotting

(C) Denaturation makes the proteins more active

(D) Insulin maintains sugar level in the blood of human body

Explanation:

Due to denaturation of proteins, helix get uncoiled and protein loses its biological activity.

Question 82.

Mixture of chloroxylenol and terpineol acts as:

[4 Marks]

(A) analgesic

(B) antibiotic

(C) antiseptic

(D) antipyretic

Explanation:

Dettol is a mixture of chloroxylenol and terpineol which is a very commonly known antiseptic.

Question 83.

The heating of phenyl-methyl ethers with HI produces

[4 Marks]

(A) Ethyl chlorides

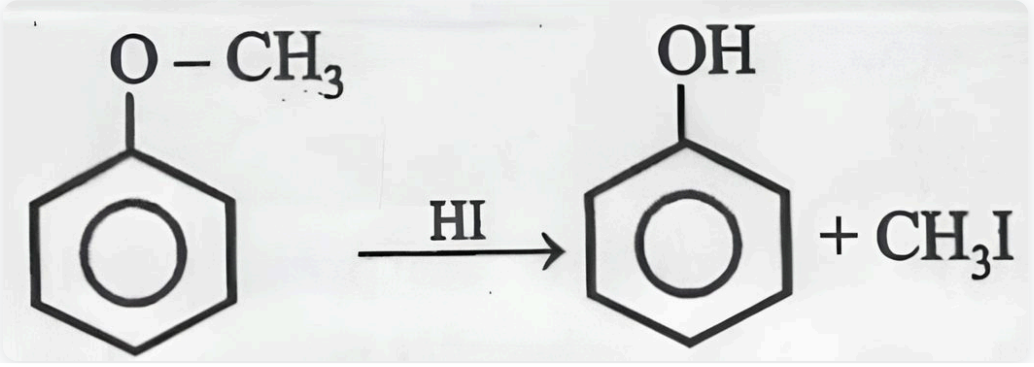
(B) Phenol

(C) Benzene

(D) Iodobenzene

Explanation:

When Ar–O–R ethers are reacted with HI, they are cleaved at weaker O–R bond to give phenol and alkyl iodide.



Question 84.

Which of the following are found in extreme saline conditions?

[4 Marks]

(A) Archaebacteria

(B) Mycobacteria

(C) Cyanobacteria

(D) Eubacteria

Explanation:

Archaebacteria are able to survive in harsh conditions due to the presence of branched lipid chain in cell membrane that reduces fluidity of cell membrane. It includes halophiles which are exclusively found in saline habitats.

Question 85.

Which of the following components provides sticky character to the bacterial cell?

[4 Marks]

(A) Plasma membrane

(B) Cell wall

(C) Glycocalyx

(D) Nuclear membrane

Explanation:

Sticky character of the bacterial wall is due to glycocalyx which is rich in glycoproteins.

Question 86.

Which among the following are the smallest living cells, known without a definite cell wall, pathogenic to plants as well as animals and can survive without oxygen?

[4 Marks]

(A) Nostoc

(B) Bacillus

(C) Pseudomonas

(D) Mycoplasma

Explanation:

Mycoplasmas are smallest, prokaryotes lacking cell wall and are pleomorphic in nature. These are pathogenic to both plants and animals.

Question 87.

Viroids differ from viruses in having:

[4 Marks]

(A) RNA molecules without protein coat

(B) DNA molecules with protein coat

(C) RNA molecules with protein coat

(D) DNA molecules without protein coat

Explanation:

Viroids in nature are sub-viral agents as infectious

RNA particles, without protein coat.

Question 88.

An example of colonial alga is:

[4 Marks]

(A) Spirogyra

(B) Chlorella

(C) Ulothrix

(D) Volvox

Explanation:

Volvox is a motile colonial fresh water green alga. It forms spherical colonies. It was first observed with a light microscope by Van Leeuwenhoek (1700) within the volvocales.

Question 89.

Zygotic meiosis is characteristic of:

[4 Marks]

(A) Fucus

(B) Funaria

(C) Chlamydomonas

(D) Marchantia

Explanation:

Chlamydomonas has haplontic life cycle hence shows

zygotic meiosis.

Question 90.

Life cycle of *Ectocarpus* and *Fucus* respectively are:

[4 Marks]

(A) Diplontic, Haplodiplontic

(B) Haplodiplontic, Haplontic

(C) Haplodiplontic, Diplontic

(D) Haplontic, Diplontic

Explanation:

Ectocarpus exhibits haplodiplontic life cycle while

Fucus has diplontic life cycle

Question 91.

Select the mismatch

[4 Marks]

(A) Cycas - Dioecious

(B) Salvinia — Heterosporous

(C) Pinus — Dioecious

(D) Equisetum - Homosporous

Explanation:

Pinus is monoecious plant comprising of both male and female cones on same plant.

Question 92.

Double fertilization is exhibited by :

[4 Marks]

(A) Gymnosperms

(B) Fungi

(C) Algae

(D) Angiosperms

Explanation:

Double fertilisation is a unique feature exhibited only by angiosperms. It involves both syngamy and triple fusion.

Question 93.

In case of poriferans, the spongocoel is lined with flagellated cells called:

[4 Marks]

(A) oscula

(B) choanocytes

(C) mesenchymal cells

(D) ostia

Explanation:

In poriferans (sponges) choanocytes (collar cells)

form lining of spongocoel. Flagella present in collar cells

provide circulation to water in water canal system.

Question 94.

An important characteristic that Hemichordates share with

Chordates is

[4 Marks]

(A) Absence of notochord

(B) Pharynx without gill slits

(C) Pharynx with gill slits

(D) Ventral tubular nerve cord

Explanation:

Pharyngeal gfll slns are present in hemlchordates and in chordates. Notochord is present in chordates only. Ventral tubular nerve cord is present in non-chordates.

Question 95.

Which among these is the correct combination of aquatic

mammals?

[4 Marks]

(A) Seals, Dolphins, Sharks

(B) Trygon, Whales, Seals

(C) Whales, Dolphins, Seals

(D) Dolphins, Seals, Trygon

Explanation:

Sharks and Trygon (sting ray) are the members of cartilag- inous fish while Whale, Dolphin and Seals are aquatic mammals belong to class mammalia.

Question 96.

Plants which produce characteristic pneumatophores and show

vivipary belong to:

[4 Marks]

(A) Halophytes

(B) Psammophytes

(C) Mesophytes

(D) Hydrophytes

Explanation:

Halophytes growing in saline soils show vivipary:

seed germination and have pneumatophores for gaseq

exchange.

Question 97.

In Bougainvillea thoms are the modifications of

[4 Marks]

(A) Stipules

(B) Leaf

(C) Stem

(D) Adventitious root

Explanation:

Thorns are hard, pointed straight structures for protection against grazing animal. These are modified stem.

Question 98.

Coconut fruit is a:

[4 Marks]

(A) Drupe

(B) Nut

(C) Capsule

(D) Bemry

Explanation:

Coconut fruit is a drupe . A drupe is a fleshy fruit with thin skin and central stone containing the seed

Question 99.

The morphological nature of the edible part of coconut is;

[4 Marks]

(A) Perisperm

(B) Pericarp

(C) Cotyledon

(D) Endosperm

Explanation:

The edible part of coconut is its endosperm. Coconut has double endosperm, liquid endosperm and cellular.

Question 100.

Root hairs develop from the region of

[4 Marks]

(A) root cap

(B) Elongation

(C) Meristematic activity

(D) Maturation

Explanation:

In roots, the root hairs develops from zone of mat ration. This zone is differentiated zone thus bearing hairs.

Question 101.

'Which of the following is made up of dead cells?

[4 Marks]

(A) Xylem parenchyma

(B) Phloem

(C) Collenchyma

(D) Phellem

Explanation:

Cork cambium undergoes periclinal division and Cuts off thick walled suberised dead cells towards outside i.e phellem (cork) and it cuts off thin walled living cells i.e., phelloderm inner side.

Question 102.

Which of the following facilitates opening of stomatal aperture?

[4 Marks]

(A) Decrease in turgidity of guard cells

(B) Radial orientation of cellulose micro-fibrils in the cell wall of guard cells

(C) Longitudinal orientation of cellulose microfibrils in the cell wall of guard cells

(D) Contraction of outer wall of guard cells

Explanation:

Cellulose microfibrils are arranged radially rather than longitudinally which makes easy for the stomata to open.

Question 103.

The vascular cambium normally gives rise to :

[4 Marks]

(A) Primary phloem

(B) Secondary xylem

(C) Periderm

(D) Phelloderm

Explanation:

During secondary growth in plants vascular cambium gives rise to secondary xylem and secondary phloem. Phelloderm is formed by cork cambium. Periderm is the corky outer layer formed in secondary thickening.

Question 104.

Frog's heart when taken out of the body continues to beat for sometime.Select the best option from the following statements.

(A) Frog is a poikilotherm.

(B) Frog does not have any coronary circulation.

(C) Heart is "myogenic" in nature.

(D) Heart is autoexcitable

[4 Marks]

(A) (C) and (D)

(B) Only (c)

(C) Only (D)

(D) (A) and (B)

Explanation:

The vertebrates process myogenic heart which is self contractile system or auto excitable; it will thus keep working outside the body for some time.

Question 105.

which of the following cell organelles is responsible for extracting energy from carbohydrates to form ATP?

[4 Marks]

(A) Lysosome

(B) Chloroplast

(C) Mitochondrion

(D) Ribosome

Explanation:

The site of aerobic oxidation of carbohydrates in cells to generate ATP are mitochondria.

Question 106.

About 98 percent of the mass of every living organism is composed of just six elements including carbon, hydrogen, nitrogen, oxygen and

[4 Marks]

(A) magnesium and sodium

(B) sulphur and magnesium

(C) calcium and phosphorus

(D) phosphorus and sulphur

Explanation:

Calcium and phosphorus are the remaining elements.

Question 107.

Which one of the following statements is correct, with reference to enzymes?

[4 Marks]

(A) Holoenzyme = Apoenzyme + Coenzyme

(B) Coenzyme = Apoenzyme + Holoenzyme

(C) Apoenzyme = Holoenzyme + Coenzyme

(D) Holoenzyme = Coenzyme + Co-factor

Explanation:

Holoenzyme is conjugated enzyme which consists of a protein part called apoenzyme and a non-protein called cofactor. Coenzyme are also organic compounds but their association with apoenzyme is only transient and acts as cofactors.

Question 108.

Which of the following options gives the correct sequence of events during mitosis?

[4 Marks]

(A) Condensation → nuclear membrane disassembly → arrangement at equator → centromere division → segregation → telophase

(B) Condensation → crossing over → nuclear membrane disassembly → segregation → telophase

(C) Condensation → arrangement at equator → centromere division → segregation → telophase

(D) Condensation → nuclear membrane disassembly → crossing over → segregation → telophase

Explanation:

The correct sequence of events occurred during mitosis would be as follows:

(i) DNA condensation occurs so that chromosomes become visible during early to mid-prophase.
(ii) Disassembly of nuclear membrane begins at late prophase or transition to metaphase.
(iii) Chromosomes align at equator during metaphase.
(iv) Centromere division occurs during anaphase forming daughter chromosomes.

(v) During anaphase segregation also occurs in which daughter chromosomes separate and move to opposite poles.
(vi) Telophase finally leads to formation of two daughter nuclei.

Question 109.

Which of the following are not polymeric?

[4 Marks]

(A) Nucleic acids

(B) Lipids

(C) Polysaccharides

(D) Proteins

Explanation:

– Nucleic acids are polymers of nucleotides.
– Proteins are polymers of amino acids.
– Polysaccharides are polymers of monosaccharides.
– Lipids are tri-esters of fatty acids with glycerol.

Question 110.

DNA replication in bacteria occurs

[4 Marks]

(A) Prior to fission

(B) During S phase

(C) Just before transcription

(D) Within nucleolus

Explanation:

In bacteria DNA replication occurs in cytoplasm prior to fission. Prokaryotes due to their primitive nature do not show well marked S-phase

Question 111.

Anaphase Promoting Complex (APC) is a protein degradation machinery necessary for proper mitosis of animal cells. If APC is defective in a human cell, which of the following is expected to occur?

[4 Marks]

(A) Chromosomes will not segregate

(B) Chromosomes will be fragmented

(C) Chromosomes will not condense

(D) Recombination of chromosome arms will occur

Explanation:

During anaphase, Anaphase Promoting Complex (APC) is a protein necessary for separation of daughter chromosomes. A defective APC will cause the chromosomes fail to segregate during anaphase.

Question 112.

The water potential of pure water is

[4 Marks]

(A) Less than zero

(B) More than zero but less than one

(C) More than one

(D) Zero

Explanation:

By convention, the water potential of pure water at standard temperature, which is not under any pressure, is taken to be zero. ($\Psi w = 0$)

Question 113.

With reference to factors affecting the rate of photosynthesis, which of the following statements is not correct?

[4 Marks]

(A) Increasing atmospheric CO_2 concentration up to 0.05% can enhance CO_2 fixation rate

(B) C_3 plants respond to higher temperatures with enhanced photosynthesis while C_4 plants have much lower temperature optimum

(C) Tomato is a greenhouse crop which can be grown in CO_2-enriched atmosphere for higher yield

(D) Light saturation for CO_2 fixation occurs at 10% of full sunlight

Explanation:

In C_3 plants photosynthesis decreases at higher temperature due to increased photorespiration.

C_4 plants have higher temperature optimum because of the presence of enzyme called pyruvate phosphate dikinase, which is sensitive to low temperature.

Question 114.

Phosphoenol Pyruvate (PEP) is the primary CO_2 acceptor in:

[4 Marks]

(A) C_4 plants

(B) C_2 plants

(C) C_3 and C_4 plants

(D) C_3 plants

Explanation:

In the mesophyll cells cytoplasm of C_4 plants like sugarcane, maize, sorghum etc. PEP is 3C compound which serves as primary CO_2 acceptor.

Question 115.

Which statement is wrong for Kreb's cycle?

[4 Marks]

(A) During the conversion of succinyl CoA to succinic acid, a molecule of GTP is synthesised.

(B) There is one point in the cycle where FAD^+ is reduced to $FADH_2$.

(C) There are three points in the cycle where NAD^+ is reduced to $NADH + H^+$.

(D) The cycle starts with condensation of acetyl group (acetyl CoA) with pyruvic acid to yield citric acid.

Explanation:

Krebs cycle begins with condensation of acetyl CoA (2C) with oxaloacetic acid (4C) to form citric acid (6C).

Question 116.

Fruit and leaf drop at early stages can be prevented by the application of

[4 Marks]

(A) Cytokinins

(B) Gibberellic acid

(C) Auxins

(D) Ethylene

Explanation:

Auxins helps to prevent premature leaf and fruit fall.

Question 117.

Which cells of "Crypts of Lieberkuhn" secrete antibacterial lysozyme?

[4 Marks]

(A) Paneth cells

(B) Zymogen cells

(C) Kupffer cells

(D) Argentaffin cells

Explanation:

– Kupffer-cells are phagocytic cells present in liver.
– Zymogen cells are enzyme producing cells which are secreted by pancreas.
– Paneth cell secrete lysozyme which acts as anti-bacterial agent, into the lumen of intestine.
– Argentaffin cells are hormone producing cells.

Question 118.

The hepatic portal vein drains blood to liver from:

[4 Marks]

(A) Kidneys

(B) Intestine

(C) Heart

(D) Stomach

Explanation:

In hepatic portal system, hepatic portal vein drains blood to liver from intestine.

Question 119.

A baby boy aged two years is admitted to play school and passes through a dental check-up. The dentist observed that the baby had twenty teeth. Which teeth were absent?

[4 Marks]

(A) Incisors

(B) Molars

(C) Pre-molars

(D) Canines

Explanation:

Total number of teeth in a human child is 20. In primary dentition premolars are absent.

Question 120.

Which of the following options best represents the enzyme composition of pancreatic juice?

[4 Marks]

(A) amylase, pepsin, trypsinogen, maltase

(B) peptidase, amylase, pepsin, rennin

(C) lipase, amylase, trypsinogen, procarboxypeptidase

(D) amylase, peptidase, trypsinogen, rennin

Explanation:

Rennin and Pepsin enzymes are present in the gastric juice whereas Maltase is present in the intestinal juice.

Question 121.

Lungs are made up of air-filled sacs, the alveoli. They do not collapse even after forceful expiration, because of:

[4 Marks]

(A) Inspiratory Reserve Volume

(B) Tidal Volume

(C) Residual Volume

(D) Expiratory Reserve Volume

Explanation:

Volume of air present in lungs after forceful expiration is residual volume prevents the collapsing of alveoli.

Question 122.

Adult human RBCs are enucleated. Which of the following statement(s) is/are most appropriate explanation for this feature?

(1) They do not need to reproduce
(2) They are somatic cells
(3) They do not metabolize
(4) All their internal space is available for oxygen transport

[4 Marks]

(A) only (1).

(B) only (4).

(C) (1), (3) and (4).

(D) (2) and (3).

Explanation:

In human RBCs, nucleus get degenerates during maturation and it provide more space for oxygen carrying pigment (haemoglobin). It lacks many cell organelles including mitochondria so respires anaerobically.

Question 123.

Which of the following statements is correct?

[4 Marks]

(A) The descending limb of loop of Henle is permeable to electrolytes.

(B) The ascending limb of loop of Henle is impermeable to water.

(C) The descending limb of loop of Henle is impermeable to water.

(D) The ascending limb of loop of Henle is permeable to water.

Explanation:

Descending limb of loop of Henle is permeable to swater but impermeable to electrolytes whereas ascending limb is impermeable to water but permeable to electrolytes.

Question 124.

The pivot joint between atlas and axis is a type of:

[4 Marks]

(A) Cartilaginous joint

(B) Synovial joint

(C) Fibrous joint

(D) Saddle joint

Explanation:

Pivot joint is a type of synovial joint which provide freely movement between atlas and axis vertebrae of vertebral column.

Question 125.

X' pairs of ribs in humans and 'Y' pairs are true ribs. Select the option that correctly represents values of X and Y and provides their explanation:

[4 Marks]

(A) X – 24, Y – 12 True ribs are dorsally attached to vertebral column but are free on ventral side.

(B) X – 12, Y – 5 True ribs are attached dorsally to vertebral column and sternum.

(C) X – 24, Y – 7 True ribs are dorsally attached to vertebral column but are free on ventral side

(D) X – 12, Y – 7 True ribs are attached dorsally to vertebral column and ventrally to the sternum.

Explanation:

In human, 12 pairs of ribs are present out of which 7 pairs of ribs 1st to 7th pair) are dorsally attached to vertebral column and ventrally to the sternum.

Question 126.

Myelin sheath is produced by:

[4 Marks]

(A) Oligodendrocytes and Osteoclasts

(B) Astrocytes and Schwann cells

(C) Schwann cells and Oligodendrocytes

(D) Osteoclasts and Astrocytes

Explanation:

Miyelin sheath wrapped around the nerve axon. Oligodendrocytes are neuroglial cells which produce myelin sheath in central nervous system while Schwann cell produces myelin sheath in peripheral nervous system.

Question 127.

Receptor sites for neurotransmitter are present on:

[4 Marks]

(A) Pre-synaptic membrane

(B) Tips of axons

(C) Post-synaptic membrane

(D) Membrane of synaptic vesicles

Explanation:

Pre-synaptic membrane is involved in the release of neurotransmitter in the chemical synapse. The receptors sites for neurotransmitters are present on post-synaptic membrane of neuron.

Question 128.

Good vision depends on adequate intake of carotene rich food.
Select the best option from the following statements:

(i) Vitamin A derivatives are formed from carotene
(ii) The photopigments are embedded in the membrane of the inner segment
(iii) Retinal is a derivative of Vitamin A
(iv) Retinal is a light absorbing part of all the visual photopigments

[4 Marks]

(A) (i) and (iv)

(B) (ii), (iii) and (iv)

(C) (i) and (iii)

(D) (i), (iii) and (iv)

Explanation:

Carotene is the source of retinal which is involved in formation of thodopsin of rod cells. Retinal, a derivative of vitamin A, is the light-absorbing part of all visual photopigments. Photopigments are occur entirely on the surface of membrane disc.

Question 129.

A decrease in blood pressure / volume will not cause the release of:

[4 Marks]

(A) Aldosterone

(B) Atrial natriuretic factor

(C) ADH

(D) Renin

Explanation:

A decrease in blood pressure / volume stimulates the release of renin, aldosterone, and ADH while increase in blood pressure / volume stimulates the release of Atrial Natriuretic Factor (ANF) secreted by atria of heart, which causes vasodilation and also inhibits RAAS (Renin Angiotensin Aldosterone System) mechanism that decreases the blood volume/pressure.

Question 130.

Attractants and rewards are required for:

[4 Marks]

(A) Entomophily

(B) Hydrophily

(C) Cleistogamy

(D) Anemophily

Explanation:

Insect pollinated plants provide rewards as edible pollen grain and nectar as usual rewards. In order to mate Hialize and maximize pollination flowers have developed a set of attributes which are aimed at attracting the pollinators called attractants.

Question 131.

Flowers which have single ovule in the ovary and are packed into inflorescence are usually pollinated by:

[4 Marks]

(A) Bat

(B) Water

(C) Bee

(D) Wind

Explanation:

Wind pollination or anemophily occurs in flowers which are having a single ovule in each ovary, and numerous flowers packed in an inflorescence. It is a non-directional pollination.

Question 132.

A dioecious flowering plant prevents both:

[4 Marks]

(A) Geitonogamy and xenogamy

(B) Autogamy and geitonogamy

(C) Autogamy and xenogamy

(D) Cleistogamy and xenogamy

Explanation:

Autogamy occurs in bisexual flowers. Geitonogamous flowers are unisexual but present in the same plant. Dioecious condition is observed when unisexual male and female flowers are present on different plants and it prevents both autogamy and geitonogamy.

Question 133.

Functional megaspore in an angiosperm develops into?

[4 Marks]

(A) Embryo

(B) Ovule

(C) Embryo sac

(D) Endosperm

Explanation:

The first cell of female gametophytic generation in angiosperm is megaspore. It undergoes three successive mitotic division to form 8-mucleated and 7-celled embryo sac.

Question 134.

Capacitation occurs in:

[4 Marks]

(A) Epididymis

(B) Female reproductive tract

(C) Rete testis

(D) Vas deferens

Explanation:

Capacitation is increase in fertilising capacity of sperms which occurs in female reproductive tract. It is required to render sperm to fertilize an oocyte.

Question 135.

The function of copper ions in copper releasing IUD's is:

[4 Marks]

(A) They inhibit ovulation

(B) They make uterus unsuitable for implantation

(C) They suppress sperm motility and fertilising capacity of sperms

(D) They inhibit gametogenesis

Explanation:

Cu^{2+}interfere in the sperm movement, ‘which suppress the sperm motility and fertilising capacity of sperms.

Question 136.

In case of a couple where the male is having a very low sperm count, which technique will be suitable for fertilisation?

[4 Marks]

(A) Gamete intracytoplasmic fallopian transfer

(B) Artificial Insemination

(C) Intracytoplasmic sperm injection

(D) Intrauterine transfer

Explanation:

Infertility cases due to inability of the male partner to inseminate the female or due to very low sperm count in the ejaculates, could be corrected by using artificial insemination (AI) technique. In this procedure, semen is injected directly into the vagina or uterus.

Question 137.

The genotypes of husband and wife are I^AI^B and I^Ai. Among the blood types of their children, how many different genotypes and phenotypes are possible?

[5 Marks]

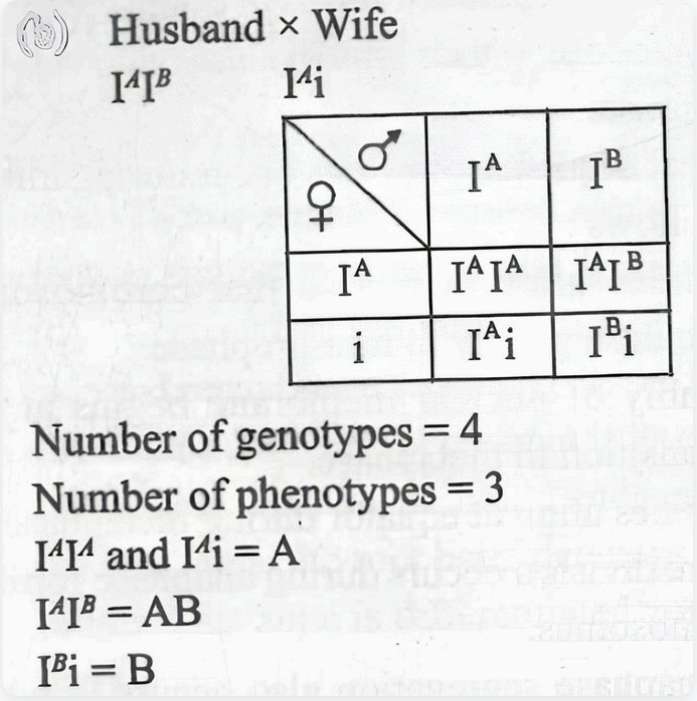
(A) 3 genotypes ; 4 phenotypes

(B) 4 genotypes ; 3 phenotypes

(C) 4 genotypes ; 4 phenotypes

(D) 3 genotypes ; 3 phenotypes

Explanation:



Question 138.

Among the following characters, which one was not considered by Mendel in his experiments on pea?

[4 Marks]

(A) Pod – Inflated or Constricted

(B) Pod – Inflated or Constricted

(C) Seed – Green or Yellow

(D) Trichomes – Glandular or non-glandular

Explanation:

During his experiments Mendel have taken seven characters in a pea plant. Among these, nature of trichomes i.e. glandular or non-glandular was not considered by Mendel.

Question 139.

Which one from those given below is the period for Mendel's hybridisation experiments?

[4 Marks]

(A) 1856 – 1863

(B) 1870 – 1877

(C) 1857 – 1869

(D) 1840 – 1850

Explanation:

According to NCERT, Mendel conducted hybridisation experiments for 7 years on Pea plant between 1856 to 1863 and his data was published in 1865.

Question 140.

Thalassemia and sickle cell anemia are caused due to a problem in globin molecule synthesis. Select the correct statement:

[4 Marks]

(A) Both are due to a qualitative defect in globin chain synthesis

(B) Sickle cell anemia is due to a quantitative problem of globin molecules

(C) Thalassemia is due to less synthesis of globin molecules

(D) Both are due to a quantitative defect in globin chain synthesis

Explanation:

Thalassemia is a quantitative problem of synthesising very few globin molecules while sickle cell anaemia is a qualitative problem of synthesising an incorrectly functioning globin.

Question 141.

A disease caused by an autosomal primary non-disjunction is:

[4 Marks]

(A) Turner's Syndrome

(B) Klinefelter's Syndrome

(C) Sickle Cell Anemia

(D) Down's Syndrome

Explanation:

Down’s syndrome is caused by non-disjunction of 21^{st} chromosome i.e. Trisomy.

Question 142.

The final proof for DNA as the genetic material came from the experiments of:

[4 Marks]

(A) Griffith

(B) Avery, Macleod and McCarty

(C) Har Gobind Khorana

(D) Hershey and Chase

Explanation:

Hershey and Chase proved that DNA as genetic material. They used bacteriophage for their experimental.

Question 143.

DNA fragments are:

[4 Marks]

(A) Positively charged

(B) Either positively or negatively charged depending on their size

(C) Neutral

(D) Negatively charged

Explanation:

DNA fragments are negatively charged because presence of phosphate group.

Question 144.

Which of the following RNAs should be most abundant

in animal cell?

[4 Marks]

(A) mi-RNA

(B) rRNA

(C) t-RAN

(D) m-RNA

Explanation:

Ribosomal RNA (rRNA) is most abundant in animal cell. It constitutes 80% of total RNA of the cell.

Question 145.

The association of histone H1 with a nucleosome indicates:

[4 Marks]

(A) DNA replication is occurring.

(B) The DNA is condensed into a Chromatin Fibre.

(C) The DNA double helix is exposed.

(D) Transcription is occurring.

Explanation:

The association of H1 protein indicates the complete formation of nucleosome which requires DNA condensa tion. The DNA is therefore in condensed form.

Question 146.

If there are 999 bases in an RNA that codes for a protein with 333 amino acids, and the base at position 901 is deleted such that the length of the RNA becomes 998 bases, how many codons will be altered?

[4 Marks]

(A) 11

(B) 33

(C) 1

(D) 333

Explanation:

If deletion happens at 901st position then the remaining 98 bases specifying for 33 codons of amino acids will be altered

Question 147.

During DNA replication, Okazaki fragments are used to

elongate:

[4 Marks]

(A) The leading strand towards replication fork.

(B) The lagging strand towards replication fork.

(C) The lagging strand away from the replication fork.

(D) The leading strand away from replication fork .

Explanation:

Two DNA polymerase molecules simultaneously work at the DNA fork, one on the leading strand and the other on the lagging strand. DNA polymerase synthesizes each Okazaki fragment a laggling strand in 5'-3' direction. As the replication fork opens further, new Okazaki fragments appear. The first Okazaki fragment appears away from the replication fork and thus the direction of elongation would be away from replication fork.

Question 148.

Spliceosomes are not found in cells of;

[4 Marks]

(A) Bacteria

(B) Plants

(C) Animals

(D) Fungi

Explanation:

In eukaryotes, spliceosomes are used in removal of introns during post-transcriptional processing of hnRNA. they are absent in prokaryotes.

Question 149.

Which of the following represents order of Horse'?

[4 Marks]

(A) Perissodactyla

(B) Caballus

(C) Equidae

(D) Ferus

Explanation:

Horse belongs to

Orders - Perissodactyla

Family - Equidae

Genus - Equus

Species - ferus

'Subspecies - caballus

Question 150.

Transplantation of tissues/organs fails often due to non-acceptance by the patient's body. Which type of immune-response is responsible for such rejections

[4 Marks]

(A) Physiological immune response

(B) Hormonal immune response

(C) Autoimmune response

(D) Cell-mediated immune response

Explanation:

Cell mediated immune response causes non-acceptance o rejection of graft or transplanted tissues/organs.Transplant rejection is caused primarily by a cell-mediated jmmune response to HLA antigens expressed on donor . antigen-presenting cells (APCs) transferred along with the transplanted organ. Recognition of donor HLA antigens on the cells of the graft induces vigorous T cell proliferation

in the recipient.

Question 151.

MALT constitutes about ..... percent of the lymphoid tissue in human body.

[4 Marks]

(A) 50%

(B) 10%

(C) 70%

(D) 20%

Explanation:

MAL Mucosa Associated Lymphoid Tissue constitutes about 50 percent of the lymphoid tissue in human body. It is scattered along mucosal lining in the human body

Question 152.

Homozygous pure lines in cattle can be obtained by:

[4 Marks]

(A) mating of individuals of different species.

(B) mating of related individuals of same breed.

(C) mating of unrelated individuals of same breed.

(D) mating of individuals of different breed.

Explanation:

Inbreeding increases homozygosity. So, mating ofthe related indi viduals of same breed will give homozygous

purelines.

Question 153.

'Which of the following in sewage treatment removes suspended solids?

[4 Marks]

(A) Sludge treatment

(B) Secondary treatment

(C) Primary treatment

(D) Tertiary treatment

Explanation:

Primary treatment is a physical process which involves two process, i.e. filtration and sedimentation of big solid waste.

Question 154.

'Which of the following is correctly matched for the product produced by them ?

[4 Marks]

(A) Penicillium notatum : Acetic acid

(B) Methanobacterium : Lactic acid

(C) Sacchromyces cerevisiae : Ethanol

(D) Acetobacter aceti : Antibiotics

Explanation:

Saccharomyces cerevisiae commonly know as Brewer's yeast, causes fermentation of carbohydrates and produces ethanol.

Question 155.

The DNA fragments separated on an agarose gel can be visualised after staining with:

[4 Marks]

(A) Acetocarmine

(B) Aniline blue

(C) Bromophenol blue

(D) Ethidium bromide

Explanation:

Ethidium bromide (EtBr) is used to stain the DNA fragments and will appear as orange coloured 'bands when kept under UV light.

Question 156.

A gene whose expression helps to identify transformed cell is known as :

[4 Marks]

(A) Plasmid

(B) Vector

(C) Selectable marker

(D) Structural gene

Explanation:

Selectable markers in recombinant DNA technology,

helps in identification and elimination of 'non-transformants

and selectively permits the growth of the transformants.

Question 157.

'What is the criterion for DNA fragments movement on agarose gel during gel electrophoresis?

[4 Marks]

(A) Negatively charged fragments do not move

(B) Positively charged fragments move to farther end

(C) The larger the fragment size, the farther it moves

(D) The smaller the fragment size, the farther it moves

Explanation:

DNA fragments during gel electrophoresis, separate

(resolve) according to their size due to sieving effect provided by agarose gel.

Question 158.

The process of separation and purification of expressed protein before marketing is called:

[4 Marks]

(A) Downstream processing

(B) Postproduction processing

(C) Bioprocessing

(D) Upstream processing

Explanation:

The various stages of processing that occur after the completion of fermentation or biosynthetic stage which include separation and purification of product called downstream processing.

Question 159.

Presence of plants arranged into well defined vertical layers depending on their height can be seen best in:

[4 Marks]

(A) Tropical Rain Forest

(B) Grassland

(C) Tropical Savannah

(D) Temperate Forest

Explanation:

The tropical rain forest have five vertical strata on the basis of plants height i.e., ground vegetation, shrubs, short canopy trees, tall canopy trees and tall emergent trees.

Question 160.

Asymptote in a logistic growth curve is obtained when :

[4 Marks]

(A) K>N

(B) K=N

(C) The value of 'r' approaches zero

(D) K

Explanation:

In logistic growth curve, the curve has an upper asymptote known as carrying capacity (K) is obtained when the maximum population size is at dN/dt = 0. A population growing in a habitat with limited resources shows logistic growth curve.
For logistic growth,
$dN/dt = rN[(K - N)/K]$
If K = N then
$(K - N)/K = 0$

$\therefore dN/dt = 0$.

The population reaches asymptote.

Question 161.

Mycorrhizae are the example of :

[4 Marks]

(A) Amensalism

(B) Antibiosis

(C) Mutualism

(D) Fungistasis

Explanation:

Mycorrhizaeis a symbiotic association between fungi and roots of higher plants.

Question 162.

Which ecosystem has the maximum biomass?

[4 Marks]

(A) Forest ecosystem

(B) Pond ecosystem

(C) Lake ecosystem

(D) Grassland ecosystem

Explanation:

Forest ecosystem has the maximum biomass.

Some very high productive ecosystem are

— Tropical rain forest

— Coral reef

— Estuaries

— Sugarcane fields

Question 163.

Alexander Von Humboldt described for the first time:

[4 Marks]

(A) Species-Area relationships

(B) Population Growth equation

(C) Laws of limiting factor

(D) Ecological Biodiversity

Explanation:

Alexander Von Humboldt noticed that within a region species richness increases with the increase in area.

Question 164.

'Which one of the following statements is not valid for aerosols?

[4 Marks]

(A) They are harmful to human health

(B) They have negative impact on agricultural land

(C) They cause increased agricultural productivity

(D) They alter rainfall and monsoon patterns

Explanation:

Aerosols through its direct or indirect effects on plants can cause various problems in agriculture. However, continuous increase in air pollution may represent a threat to agriculture in the future that is persistent and largely irreversible.

Question 165.

Artificial selection to obtain cows yielding higher milk

output represents :

[4 Marks]

(A) Directional as it pushes the mean of the character in one direction

(B) Disruptive as it splits the population into two, one yielding higher output and the other lower output

(C) Stabilizing followed by disruptive as it stabilizes the population to produce higher yielding cows

(D) Stabilizing selection as it stabilizes this character in the population

Explanation:

Artificial selection to obtain cow yielding higher milk output will shift the peak to one direction, so this represent an example of Directional selection. In stabilizing selection, the organisms with the mean value of the trait are selected. In disruptive selection, both extremes get selected.

Question 166.

Select the mismatch :

[4 Marks]

(A) Rhodospirillum - Mycorrhiza

(B) Rhizobium - Alfalfa

(C) Frankia - Alnus

(D) Anabaena - Nitrogen fixer

Explanation:

Rhodospirillum is facultative anaerobe and free living nitrogen fixer. Mycorrhiza show symbiotic relationship between fungi and roots of higher plants.

Question 167.

Which one of the following is related to Ex-situ conservation of threatened animals and plants ?

[4 Marks]

(A) Wildlife safari parks

(B) Amazon rainforest

(C) Himalayan region

(D) Biodiversity hotspots

Explanation:

Ex-situ conservation is offsite strategy for conservation of biological diversity in zoological park and botanical gardens respectively.

Question 168.

A temporary endocrine gland in the human body is:

[4 Marks]

(A) Pineal gland

(B) Corpus allatum

(C) Corpus cardiacum

(D) Corpus luteum

Explanation:

Corpus luteum is the temporary endocrine gland formed in the ovary after ovulation. It release hormones like progesterone, oestrogen etc.

Question 169.

Match the following sexually transmitted diseases (Column-I) with their causative agent (Column-II) and select the correct option :

[4 Marks]

Column-I	Column-II
(A) Gonorrhea	(i) HIV
(B) Syphilis	(ii) *Neisseria*
(C) Genital Warts	(iii) *Treponema*
(D) AIDS	(iv) Human papilloma-Virus

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

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

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

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

Explanation:

Gonorrhoea – Neisseria (Bacteria)
Syphilis – Treponema (Bacteria)
Genital Warts – Human papilloma virus
AIDS – HIV (Virus)

Question 170.

'Which of the following in sewage treatment removes suspended solids

[4 Marks]

(A) Secondary treatment

(B) Sludge treatment

(C) Primary treatment

(D) Tertiary treatmen

Explanation:

Primary treatment is a physical process which involves two process, i.e. filtration and sedimentation of big solid waste.

Question 171.

Select the correct route for the passage of sperms in male frogs:

[4 Marks]

(A) Testes → Vasa efferentia → Bidder's canal → Ureter → Cloaca

(B) Testes → Vasa efferentia → Kidney → Bidder's canal → Urinogenital duct → Cloaca

(C) Testes —> Vasa efferentia —> Kidney —> Seminal Vesicle—> Urinogenital duct—> Cloaca

(D) Testes → Bidder's canal → Kidney → Vasa efferentia → Urinogenital duct → Cloaca

Explanation:

In male frog the sperms passage is:
Testes → Vasa efferentia → Kidney → Bidder's canal → Urinogenital duct → Cloaca.

Question 172.

GnRH, a hypothalamic hormone, needed in reproduction, acts on:

[4 Marks]

(A) anterior pituitary gland and stimulates secretion of LH and FSH.

(B) posterior pituitary gland and stimulates secretion of LH and relaxin.

(C) anterior pituitary gland and stimulates secretion of LH and oxytocin.

(D) posterior pituitary gland and stimulates secretion of oxytocin and FSH.

Explanation:

GnRH is secreted by hypothalamus which stimulates anterior pituitary gland for the secretion of gonadotropins (FSH and LH).

Question 173.

Identify the wrong statement in context of heartwood:

[4 Marks]

(A) Organic compounds are deposited in it

(B) It comprises dead elements with highly lignified walls

(C) It conducts water and minerals efficiently

(D) It is highly durable

Explanation:

Heartwood is inactive physiologically due to deposition of organic compounds and formation of tyloses so it will not conduct water and minerals.

Question 174.

Consider a drop of rain water having mass 1 g falling from a height of 1 km. It hits the ground with a speed of 50 m/s. Take 'g' constant with a value 10 m/s^2. The work done by the(i) gravitational force and

(ii) resistive force of air is

[4 Marks]

(A) (i) 1.25 J (ii) −8.25 J

(B) (i) 10 J (ii) −8.75 J

(C) (i) −10 J (ii) −8.25 J

(D) (i) 100 J (ii) 8.75 J

Explanation:

From work-energy theorem,

$W_g + W_a = \Delta K.E.$

or, $mgh + W_a = 1/2\ mv^2 - 0$

$10^{-3} \times 10 \times 10^3 + W_a = 1/2 \times 10^{-3} \times (50)^2$

$\Rightarrow W_a = -8.75$ J

which is the work done due to air resistance

Work done due to gravity = mgh
$= 10^{-3} \times 10 \times 10^3 = 10$ J

Question 175.

Which of the following statements are correct?

(A) Centre of mass of a body always coincides with the centre of gravity of the body.
(B) Centre of mass of a body is the point at which the total gravitational torque on the body is zero.
(C) A couple on a body produce both translational and rotation motion in a body.
(D) Mechanical advantage greater than one means that small effort can be used to lift a large load.

[4 Marks]

(A) (B) and (D)

(B) (C) and (D)

(C) (B) and (C)

(D) (A) and (B)

Explanation:

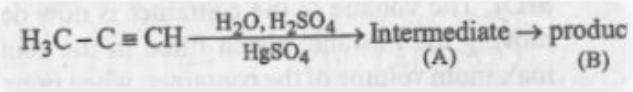
Mechanical advantage, M.A = Load/Effort

If M.A. > 1 ⇒ Load > Effort

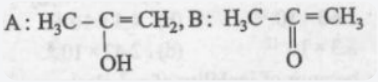
Question 176.

Predict the correct intermediate and product in the following reaction

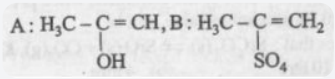
[4 Marks]



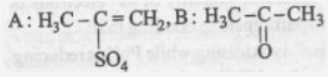
(A)



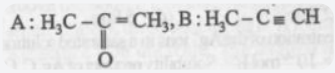
(B)



(C)

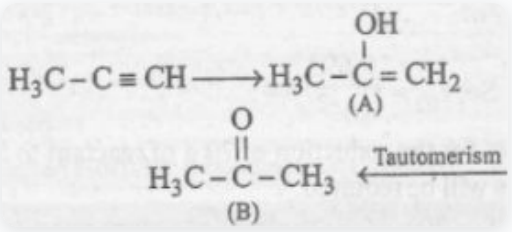


(D)



Explanation:

Hydration of alkynes give ketones.



Question 177.

Match the interhalogen compounds of column-I with the geometry in column II and assign the correct code.

[4 Marks]

	Column-I		Column-II
1.	XX'	(i)	T-shape
2.	XX'_3	(ii)	Pentagonal bipyramidal
3.	XX'_5	(iii)	Linear
4.	XX'_7	(iv)	Square-pyramidal
		(v)	Tetrahedral

(A) 1-iii 2-iv 3-i 4-ii

(B) 1-iv 2-iii 3-ii 4-i

(C) 1-v 2-iv 3-iii 4-ii

(D) 1-iii 2-i 3-iv 4-ii

Explanation:

XX' → Linear (e.g. ClF, BrF)

XX_3' → T-Shape (e.g. ClF_3, BrF_3)

XX_5' → Square pyramidal (e.g. BrF_5, IF_5)

XX_7' → Pentagonal bipyramidal (e.g. IF_7)

Question 178.

Which one is the most acidic compound ?

[4 Marks]

(A)



(B)



(C)



(D)



Explanation:

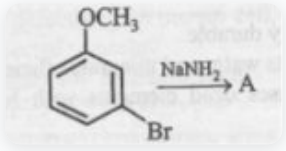
Electron withdrawing—NO_2, group has very strong -I

and —R effects so, compound 3 will be most acidic.

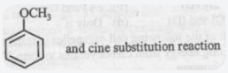
Question 179.

Identify A and predict the type of reaction

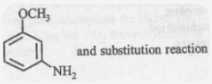
[4 Marks]



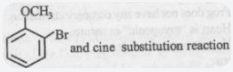
(A)



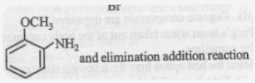
(B)



(C)



(D)



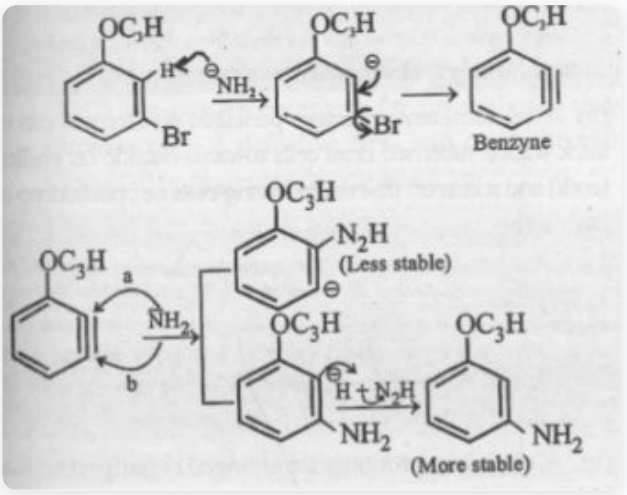
Explanation:

More stable as —ve charge is close to electron withdrawing group.

Also, incoming nucleophile gets attached on same 'C'on

which 'Br' (Leaving group) was present.

. nota cine substitution reaction.

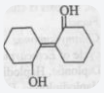


Question 180.

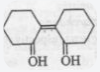
out of the following, which is the product formed when cyclohexanone undergoes aldol condensation followed by heating ?

[4 Marks]

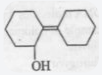
(A)



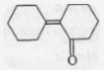
(B)



(C)



(D)



Explanation:

More stable as —ve charge is close to electron withdrawing group.

Also, incoming nucleophile gets attached on same 'C'on

which 'Br' (Leaving group) was present.

. nota cine substitution reaction.

