CAREERS 360

PRACTICE Series

BITSAT 2025

Sample Paper

BITSAT 2025

Physics

Q. 1 Two objects of equal mass hit a wall with the same velocity. They both rebound with the same velocity. Both objects experience the same momentum change but one experiences twice the force as the other. Which of the following statements is true?

Option 1:
the contact time between the object and the wall of one is twice the contact time of the other

Option 2:
the contact time between the object and the wall of one is equal to the contact time of the other

Option 3:
the contact time between the object and the wall of one is one-half the contact time of the other

Option 4:
the change in the kinetic energy is the same for the two objects.

Correct Answer:
the contact time between the object and the wall of one is twice the contact time of the other

Solution:
As we learnt in

Perfectly Elastic Collision -

$$e = 1$$

- wherein

$$e \ : \ coefficient\, of\, restitution$$

The contact time between the object and the wall of one is twice the contact time of other.

Q. 2 Three charges $4q, Q$ and q are in a straight line in the position of 0, $l/2$ and L respectively. The resultant force on q will be zero, if $Q =$

Option 1:
$-q$

Option 2:
$-2q$

Option 3:
$-\frac{q}{2}$

Option 4:
$4q$

Correct Answer:
$-q$

Solution:
As we learned

Coulombic force -

$$F \propto Q_1Q_2 \Rightarrow F \propto \frac{Q_1Q_2}{r^2} \Rightarrow F = \frac{KQ_1Q_2}{r^2}$$

- wherein

K - proportionality Constant

Q_1 and Q_2 are two Point charge

The force between $4q$ and q ; $F_1 = \frac{1}{4\pi\varepsilon_0}.\frac{4q \times q}{l^2}$

The force between Q and q ; $F_2 = \frac{1}{4\pi\varepsilon_0}.\frac{Q \times q}{(l/2)^2}$

We want $F_1 + F_2 = 0 \; or \; \frac{4q^2}{l^2} = -\frac{4Qq}{l^2} \Rightarrow Q = -q$

Q. 3 In stream line flow, tangent at a point on its path will give

Option 1:
Velocity

Option 2:
Rate of flow

Option 3:
Speed

Option 4:
Direction of velocity

Correct Answer:
Direction of velocity

Solution:
As we have learnt

Property of stream line flow -

Straight -curved -tangent

- wherein

Direction of velocity at any point on the flow line is along the tangent.

Tangent at a point will give direction of velocity.

Q. 4 Drums of oil are carried in a truck. If the truck accelerates at a constant rate, the surface of the oil in the drum will:

Option 1:
Remain unaffected

Option 2:
Rise in forward direction

Option 3:
Rise in backward direction

Option 4:
Nothing is certain

Correct Answer:
Rise in backward direction

Solution:
As we learnt in

Non Inertial Frame of Reference -

Accelerated frames are Non Inertial.

Examples- car moving with uniform circular motion, plane which is taking off.

- wherein

Newton's law are not valid

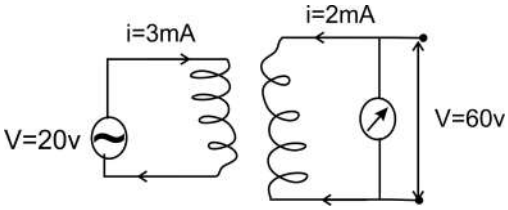
$\vec{a} \neq 0, \quad if \vec{F} = 0$

$*$ pseudo $(-m\vec{a})$ act on the body.

- means direction opposite

The surface of oil rise in backward direction because frame will behave as non inertial.

Q. 5



Find the efficiency of given step up transformer

Option 1:
2 %

Option 2:
20 %

Option 3:
4 %

Option 4:
40 %

Correct Answer:
20 %

Solution:
As we learnt ,

Efficiency of transformer -

Ratio of out power and input power.

-

efficiency ,

$$\eta = \frac{Output\ power}{Input\ power}$$

$$\eta = \frac{V_S I_S}{V_P I_P}$$

$$\eta = \frac{60 \times 0.2}{20 \times 3}$$

$$\eta = 0.2$$

$$\eta\% = 20\%$$

Q. 6 Expansion in surface area due to heating is proportional to

Option 1:
original area

Option 2:
change in temperature

Option 3:
volume of the body

Option 4:
both (1) and (2)

Correct Answer:
both (1) and (2)

Solution:
As we learned

Change in Area -

$$\Delta A = A_0 \beta \Delta T$$

- wherein

$$\Delta A = A - A_0$$

$A - A_0 =$ Change in Area

$$\Delta T = T - T_0$$

$T - T_0 =$ Change in temperature

$\Delta A \propto A_0$
and
$\Delta A \propto \Delta T$

Q. 7 A particle of mass 2kg is moving such that at time t,its position, in meter, is given by $\vec{r}(t) = 5\hat{i} - 2t^2\hat{j}$. The angular momentum of the particle at t=2s about the origin in kg $m^{-2}s^{-1}$ is

Option 1:
$-80\hat{k}$

Option 2:
$\left(10\hat{i} - 16\hat{j}\right)$

Option 3:
$-40\hat{k}$

Option 4:
$40\hat{k}$

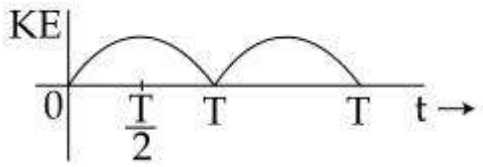
Correct Answer:
$-80\hat{k}$

Solution:

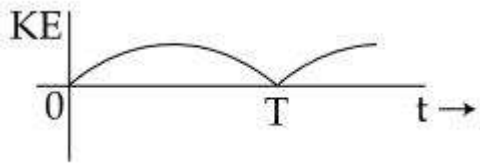
$$\vec{P} = m\vec{v} = m\frac{d\vec{r}}{dt} = 2(-4t)\hat{j} = -16\hat{j}$$
(putting $t = 2$)
$\vec{r} = 5\hat{i} - 8\hat{j}$
$\vec{L} = \vec{r} \times \vec{p}$
Substituting. $\vec{L} = (5\hat{i} - 8\hat{j}) \times (-16\hat{j})$ $\vec{L} = -80\hat{k}$

Q. 8 A particle is executing simple harmonic motion with a time period T. At time t=0, it is at its position of equilibrium. The kinetic energy - time graph of the particle will look like :

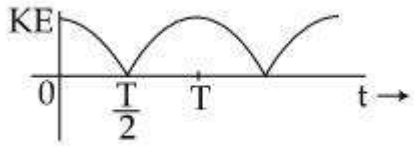
Option 1:



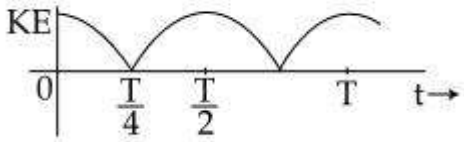
Option 2:



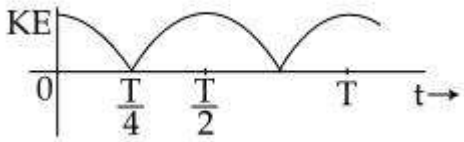
Option 3:



Option 4:



Correct Answer:



Solution:
As we learnt in

Total energy in S.H.M. -

Total Energy = Kinetic + Potential Energy

- wherein

Total Energy = $\frac{1}{2}K\left(A^2-x^2\right)+\frac{1}{2}kx^2=\frac{1}{2}kA^2$

Hence total energy in S.H.M. is constant

At mean position t = 0, $\omega t=0$, y = 0

$v=v_{max}=a\omega$

$\therefore \quad K.E.=K.E_{max}=\frac{1}{2}m\omega^2a^2$

At extreme position $t=\frac{T}{4}, \quad \omega=\frac{\pi}{2}, \quad y=A$

$v_{min} = 0 \ \ \therefore \ \ K.E. = K.E_{min} = 0$

K.E. in S.H.M. = K.E.$= \frac{1}{2}m\omega^2(a^2 - y^2)$

$y = a\ sin\omega t$

$K.E. = \frac{1}{2}m\omega^2(a^2 - a^2 sin^2\omega t) = \frac{1}{2}m\omega^2 a^2(1 - sin^2\omega t)$

$\therefore \ \ K.E. = \frac{1}{2}m\omega^2 a^2 cos^2\omega t$

Correct option is 4.

Q. 9 Dimensional formula of dielectric constant is equals to

Option 1:
$[ML^3T^{-4}A^2]$

Option 2:
$[ML^2T^{-4}A^2]$

Option 3:
$[M^0L^0T^0]$

Option 4:
$[ML^2T^{-2}A^2]$

Correct Answer:
$[M^0L^0T^0]$

Solution:
As we have learnt,

dielectric constant (k) -

$M^0L^0T^0$

- wherein

Unitless

Dielectric constant is dimensionless

$$K = \epsilon_r = \frac{\epsilon}{\epsilon_0}$$

It is a ratio of the permittivity of medium to the permittivity of vacuum.

Q. 10 An ideal gas enclosed in a vertical cylindrical container supports a freely moving piston of mass M. The piston and the cylinder have cross sectional area A. When the piston is in equilibrium, the volume of the gas is V_0 and its pressure is P_0 . The piston is slightly displaced from the equilibrium position and released.Assuming that the system is completely isolated from its surrounding,the piston executes a simple harmonic motion with frequency:

Option 1:
$$\frac{1}{2\pi}\sqrt{\frac{MV_0}{A\gamma P_0}}$$

Option 2:
$$\frac{1}{2\pi}\frac{A\gamma P_0}{V_0 M}$$

Option 3:
$$\frac{1}{2\pi}\frac{V_0 M P_0}{A^2\gamma}$$

Option 4:
$$\frac{1}{2\pi}\sqrt{\frac{A^2\gamma P_0}{MV_0}}$$

Correct Answer:
$$\frac{1}{2\pi}\sqrt{\frac{A^2\gamma P_0}{MV_0}}$$

Solution:
As we have learned

Relation between slope of isothermal and adiabatic process -

$$\frac{dP}{dV}_{isothermal} = -\frac{P}{V}$$

$$\frac{dP}{dV}_{adiabatic} = -\gamma\frac{P}{V}$$

- wherein

$$Slope\,of\,adiabatic\,process = \gamma \times Slope\,of\,isothermal\,process$$

At equilibrium

$$V = V_0, P = P_0$$

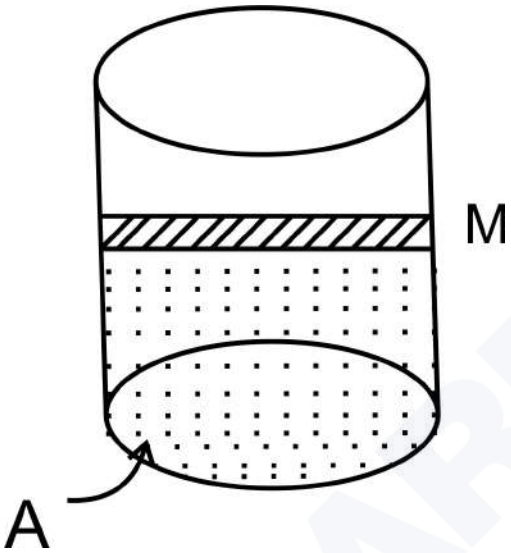
Let the atmospheric pressure is pa

$$(P_0 - Pa)A = Mg.....(1)$$

Let piston is displaced slightly into the cylinder then pressure become $P_0 + dP$

$$\Rightarrow Net \quad force = Mg - (P_0 + dP)A + P_aA$$

$$F = -dPA.....(2)$$



Since the cylinder is isolated, then the process is adiabatic $\Rightarrow PV^r = constant$

$$\Rightarrow V^\gamma + P^\gamma V^{\gamma-1}dV = 0$$

$$or \;\; dP = \frac{-\gamma P}{V}dV$$

$$\therefore F = -\frac{\gamma P_0}{V_0}AdV$$

$$dV = Adx$$

$$F = \frac{-P_0\gamma A}{V_0}Adx = \frac{-\gamma A^2 P_0}{V_0}dx$$

Acceleration = F/M = $= \frac{-\gamma A^2 P_0}{MV_0}dx$

This equation is of SHM with

$$w^2 = \left(\frac{\gamma P_0 A^2}{M V_0}\right)$$

$$T = 2\pi\sqrt{\frac{MV_0}{\gamma P_0 A^2}}$$

$$= 1/T = \frac{1}{2\pi}\sqrt{\frac{\gamma P_0 A^2}{MV_0}}$$

Q. 11 Two particles move at right angle to each other. Their de Broglie wavelengths are λ_1 and λ_2 respectively. The particles suffer perfectly inelastic collision. The de Broglie wavelength λ, of the final particle, is given by :

Option 1:
$$\lambda = \frac{\lambda_1 + \lambda_2}{2}$$

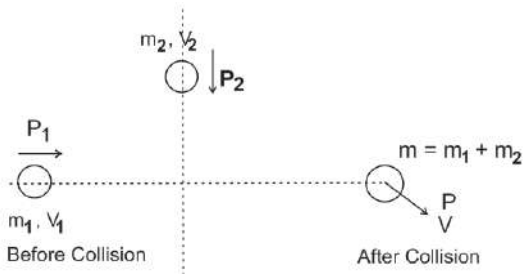
Option 2:
$$\lambda = \sqrt{\lambda_1 + \lambda_2}$$

Option 3:
$$\frac{1}{\lambda} = \frac{1}{\lambda_1^2} + \frac{1}{\lambda_2^2}$$

Option 4:
$$\frac{2}{\lambda} = \frac{1}{\lambda_1} + \frac{1}{\lambda_2}$$

Correct Answer:
$$\frac{1}{\lambda} = \frac{1}{\lambda_1^2} + \frac{1}{\lambda_2^2}$$

Solution:



$$P_1 \hat{i} - P_2 \hat{j} = \vec{P} \ldots\ldots \quad (1)$$

We know $P = \frac{h}{\lambda}$

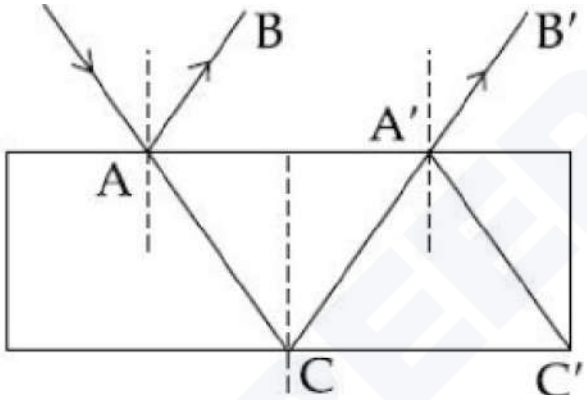
$$\Rightarrow \frac{h}{\lambda_1} \hat{i} - \frac{h}{\lambda_2} \hat{j} = \frac{h}{\lambda}$$

$$\Rightarrow \frac{h}{\lambda} = \left(\sqrt{\frac{1}{{\lambda_1}^2} + \frac{1}{{\lambda_2}^2}} \right) * h$$

$$\Rightarrow \lambda = \frac{\lambda_1 \lambda_2}{\sqrt{{\lambda_1}^2 + {\lambda_2}^2}}$$

or $\frac{1}{\lambda} = \frac{1}{\lambda_1^2} + \frac{1}{\lambda_2^2}$

Q. 12 A ray of light of intensity **I** is incident on a parallel glass slab at point A as shown in diagram. It undergoes partial reflection and refraction. At each reflection, 25% of incident energy is reflected. The rays AB and A' B' undergo interference. The ratio of I_{max} and I_{min} is :



Option 1:
$49 : 1$

Option 2:
$7 : 1$

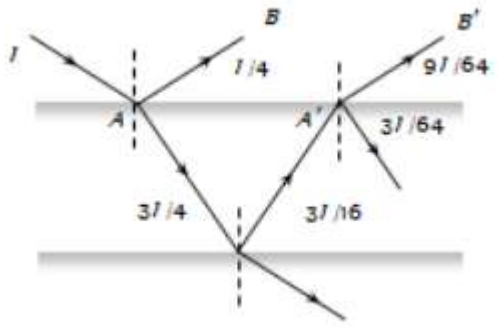
Option 3:
$4 : 1$

Option 4:
$8 : 1$

Correct Answer:

$49 : 1$

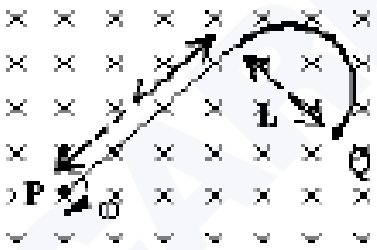
Solution:



$$\text{From figure } I_1 = \frac{I}{4} \text{ and } I_2 = \frac{9I}{64} \Rightarrow \frac{I_2}{I_1} = \frac{9}{16}$$

$$\text{By using } \frac{I_{\max}}{I_{\min}} = \left(\frac{\sqrt{\frac{I_2}{I_1}}1}{\sqrt{\frac{I_2}{I_1}} - 1}\right) = \left(\frac{\sqrt{\frac{9}{16}} + 1}{\sqrt{\frac{9}{16}} - 1}\right) = \frac{49}{1}$$

Q. 13 When a 'J' shaped conducting rod is rotating in its own plane with constant angular velocity ω about one of its ends P, in a uniform magnetic field $\vec{B}$ (directed normally into the plane of paper) then magnitude of emf induced across it will be



Option 1:

$Bw\sqrt{L^2 + l^2}$

Option 2:

$\frac{1}{2}Bwl^2$

Option 3:

$\frac{1}{2}Bw\left(L^2+l^2\right)$

Option 4:

$\frac{1}{2}Bwl^2$

Correct Answer:

$\frac{1}{2}Bw\left(L^2+l^2\right)$

Solution:

As we learnt in

Motional E.m.f due to rotational motion -

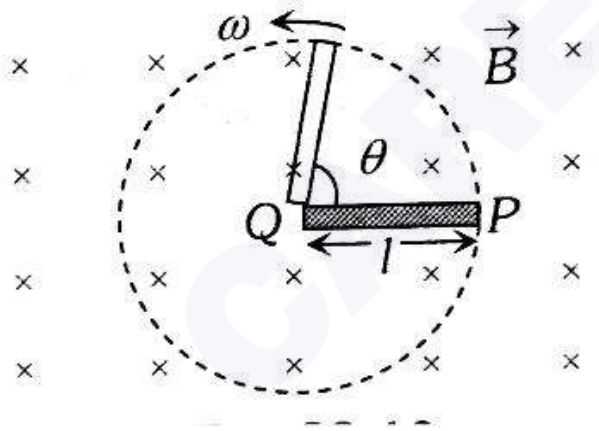
Conducting rod $\rightarrow$

$$\varepsilon=\frac{1}{2}Bl^2\omega=Bl^2\pi\nu$$

$\nu \rightarrow frequency$

$T \rightarrow Time\ period$

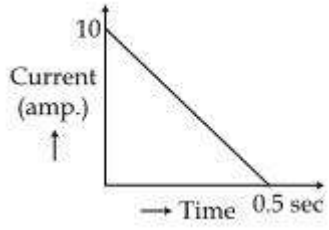
- wherein



This system can be replaced by a single rod of length = $\sqrt{l^2+L^2}$

$\therefore$ e.m.f induced = $\frac{1}{2}B\omega\left(l^2+L^2\right)$

Q. 14 In a coil of resistance 100 , a current is induced by changing the magnetic flux through it as shown in the figure. The magnitude of change in flux (in Wb) through the coil is :



Option 1:
250

Option 2:
225

Option 3:
200

Option 4:
275

Correct Answer:
250

Solution:
As we have learned

The Induced current is given by

$$i = \frac{1}{R} \cdot \frac{d\phi}{dt}$$

So

$$\Delta\phi = R \cdot \Delta q$$
$$= 100\Omega \times (Area\ \ of\ \ i\ vs\ t\ \ graph)$$
$$= 100 \times (1/2 \times 10 \times 0.50) = 250wb$$

Q. 15 If two vectors has the same starting point then vectors called as

Option 1:
equal vectors

Option 2:
Negative vectors

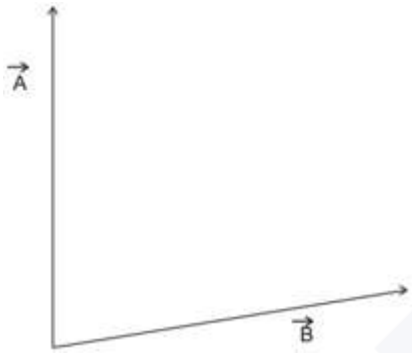
Option 3:
collinear vectors

Option 4:
co - initial vectors

Correct Answer:
co - initial vectors

Solution:

co - initial vectors



$\vec{A}\,and\,\vec{B}$ are co-initial vectors. If two vectors have the same initial point then they are called co-initial vectors.

Q. 16 When a body is projected from height h parallel to horizontal with velocity u then equation of trajectory of body is (taking upward direction as positive y - axis) -

Option 1:
$y=\frac{1}{2}g\frac{x^2}{u^2}$

Option 2:
$y=\frac{1}{2}g\frac{u^2}{x^2}$

Option 3:

$y = -\frac{1}{2}g\frac{x^2}{u^2}$

Option 4:

$y = -\frac{1}{2}g\frac{u^2}{x^2}$

Correct Answer:

$y = -\frac{1}{2}g\frac{x^2}{u^2}$

Solution:
Equation of path of a projectile

$$y = \frac{g}{2u^2}.x^2$$

$g \rightarrow$ Acceleration due to gravity

$u \rightarrow$ initial velocity

because,

$$x = u \times t = ut \Rightarrow t = \frac{x}{u}$$
$$y = ut - \frac{1}{2}gt^2 = -\frac{1}{2}gt^2$$
$$So\ y = -\frac{1}{2}g\left[\frac{x}{u}\right]^2$$

Q. 17 A clock with a metal pendulum beating seconds keep correct time at $0^0\mathrm{C}$. If it loses 12.5 s a day at $25^0\mathrm{C}$, the coefficient of linear expansion of metal pendulum is

Option 1:

$\frac{1}{86400}/^0\mathrm{C}$

Option 2:

$\frac{1}{43200}/^0\mathrm{C}$

Option 3:

$\frac{1}{14400}/^0\mathrm{C}$

Option 4:

$\frac{1}{28800}/^0\mathrm{C}$

Correct Answer:

$\frac{1}{86400}/^0\mathrm{C}$

Solution:
As we learned

Effect of temperature on Simple Pendulum -

$$\frac{\Delta T}{T}=\frac{1}{2}\,\alpha\,\Delta\theta$$

- wherein

$\Delta\theta=\theta-\theta_0$

$\Delta\theta=$ Change in temperature

$\frac{\Delta T}{T}=\frac{1}{2}\alpha\Delta\Theta$ or $\Delta T=\frac{1}{2}\alpha\Delta\theta\cdot T$

$\Rightarrow 12.5=\frac{1}{2}\times 2\times 25\times 86400$

or $\alpha=\frac{1}{86400}/^0\mathrm{C}$

Q. 18 A metal wire of resistance $3\,\Omega$ is elongated to make a uniform wire of double its previous length . This new wire is now bent and the ends joined to make a circle . If two points on this circle make an angle 60° at the centre , the equivalent resistance between these two points will be :

Option 1:

$\frac{12}{5}\Omega$

Option 2:

$\frac{5}{12}\Omega$

Option 3:

$\frac{5}{3}\Omega$

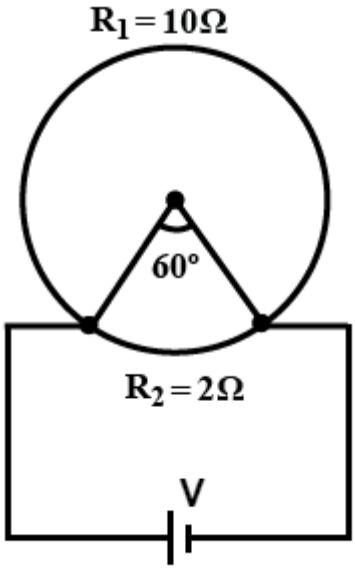
Option 4:

$\frac{7}{2}\Omega$

Correct Answer:

$\frac{5}{3}\Omega$

Solution:



$R_{initial} = 3\ \Omega$

After elongation

Vol of wire initial = vol of wire final

$\Rightarrow \pi\, r_i^2 l_i = \pi r_f^2\, 2\, l_i$

$\Rightarrow \quad r_f^2 = \frac{r_i^2}{2}$

$R_i = \rho\, \frac{l}{A} = \rho\, \frac{l_i}{\pi\, r_i^2}$

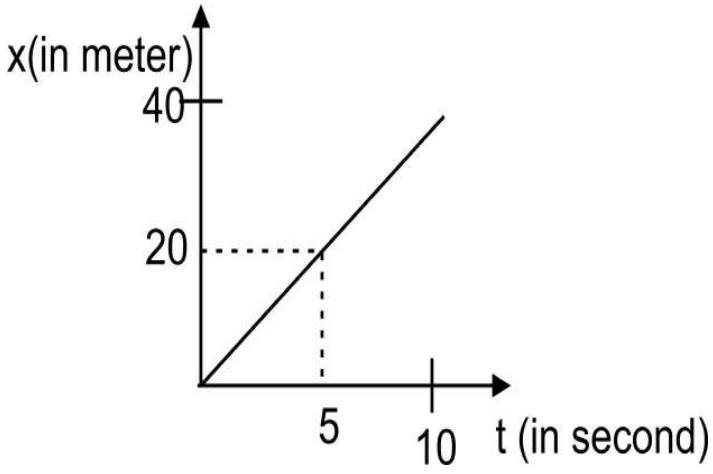
$R_{final}(after\ \ elongation) = \rho\, \frac{2l_i}{\pi \frac{r_i^2}{2}} = 4Ri = 12\Omega$

$R_1 = \frac{\left(\frac{5\pi}{3}\right)}{2\pi} \times 12 = 10\Omega$

$R_2 = \frac{\left(\frac{\pi}{3}\right)}{2\pi} \times 12 = 2\Omega$

$$R_{eq} = \frac{R_1 R_2}{R_1 + R_2} = \frac{5}{3}\Omega$$

Q. 19 Position time graph of a particle is given in the figure its velocity (in m/s) is



Option 1:
4

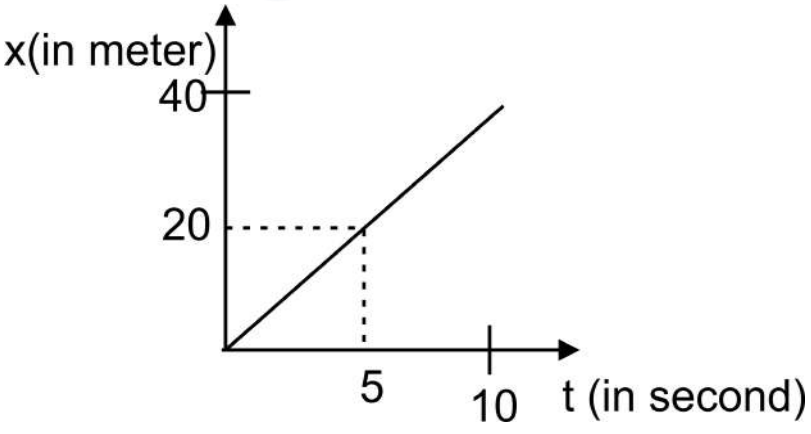
Option 2:
3

Option 3:
2

Option 4:
1

Correct Answer:
4

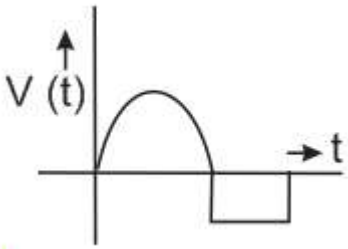
Solution:



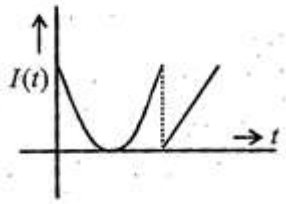
The velocity of particle = Slope of the graph = $\frac{\Delta x}{\Delta t}$

$$= \frac{20\,m}{5\,sec} = 4\,m/s$$

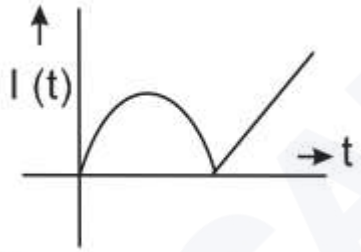
Q. 20 Two coils, X and Y, are kept in close vicinity of each other. When a varying current, I(t), flows through coil X, the induced emf (V(t)) in coil Y, varies in the manner shown here. The variation of I(t), with time, can then be represented by the graph labelled as graph:



Option 1:



Option 2:



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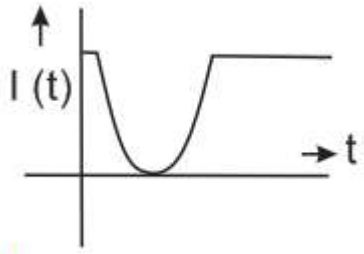
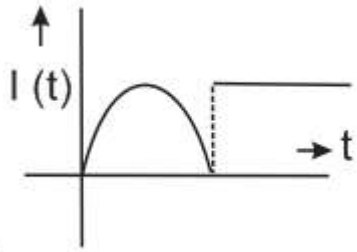
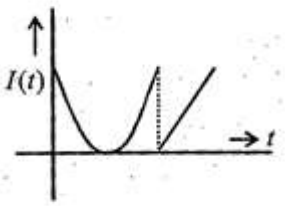


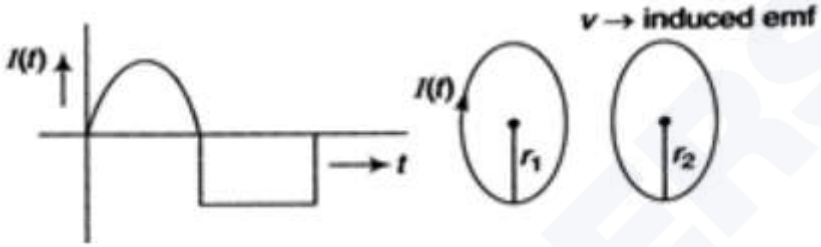
Option 4:



Correct Answer:



Solution:



$$e = -\frac{d\phi}{dt} = -\frac{d}{dt}(B \cdot A)$$

$$= -A\cos\theta\frac{d}{dt}(B)$$

$$= -A\cos\frac{d}{dt}\left[\frac{\mu_0 I}{2r_1}\right]$$

$$e = -\frac{A\cos\theta\mu_0}{2r_1}\frac{dI}{dt}$$

$$e \propto -\frac{dI}{dt}$$

This means e will vary as the negative of the slope variation of I(t).

Q. 21 A copper ball of mass 100 gm is at a temperature T. It is dropped in a copper calorimeter of mass 100 gm, filled with 170 gm of water at room temperature. Subsequently, the temperature of the system is found to be 75^0C. T is given by :

(Given : room temperature=30^0C, specific heat of copper=0.1 cal/gm^{0}C)

Option 1:
800^0C

Option 2:
885^0C

Option 3:
1250^0C

Option 4:
825^0C

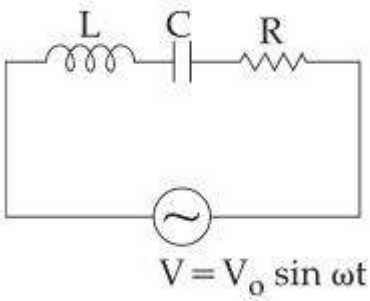
Correct Answer:
885^0C

Solution:
As we have learnt

As we know Heat given = Heat Taken

$$\Rightarrow 100 \times 0.1 \times (T - 75) = (100 \times 0.1 \times 45) + (170 \times 1 \times 45)$$
$$10(T - 75) = 8100$$
$$T - 75 = 810 \Rightarrow T = 885^{\circ}C$$

Q. 22 For the LCR circuit, shown here, the current is observed to lead the applied voltage. An additional capacitor C', when joined with the capacitor C present in the circuit, makes the power factor of the circuit unity. The capacitor C', must have been connected in :



Option 1:

series with C and has a magnitude $\frac{1-\omega^2 LC}{\omega^2 L}$

Option 2:

series with C and has a magnitude $\frac{C}{(\omega^2 LC-1)}$

Option 3:

parallel with C and has a magnitude $\frac{C}{(\omega^2 LC-1)}$

Option 4:

parallel with C and has a magnitude $\frac{1-\omega^2 LC}{\omega^2 L}$

Correct Answer:

parallel with C and has a magnitude $\frac{1-\omega^2 LC}{\omega^2 L}$

Solution:

As we learnt in

Power factor -

Ratio of resistance and impedance$(cos\phi)$.

-

$$\therefore \frac{1}{\omega C} > \omega L - - - - - - - - - -1$$

After inserting $_C/$ both become equal since $cos\phi = \frac{R}{Z} = 1$

or $R^2 = R^2 + (X_L - X_C)^2$

$$=> X_L = X_C - - - - - - - - - -2$$

This implied X_c must reduced

This will happen when C is increased.

$\therefore C'$ must be inserted in parellel to C.

$$\therefore \omega L = \frac{1}{\omega(C + C')}$$

or $C + C' = \frac{1}{\omega^2 L}$ or $C' = \frac{1}{W^2 L} - C$

or $C' = \frac{1 - \omega^2 LC}{\omega^2 L}$

Q. 23 What is approximate numerical value of Bohr Magneton?

Option 1:
$9.27 \times 10^{-25} J/T$

Option 2:
$9.27 \times 10^{-27} W/T$

Option 3:
$9.27 \times 10^{-24} J/T$

Option 4:
$9.27 \times 10^{-25} W/T$

Correct Answer:
$9.27 \times 10^{-24} J/T$

Solution:

$$\mu = n\frac{-e}{2m_e}\frac{h}{2\pi}$$

$$\mu = -n\frac{eh}{4\pi m_e}$$

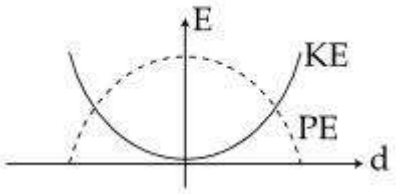
If we put n =1, then the equation become -

$$\mu_B = -\frac{eh}{4\pi m_e} = 9.27 \times 10^{-24} J/T$$ (This is called Bohr Magneton μ_B)

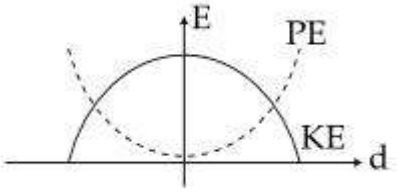
Q. 24 For a simple pendulum, a graph is plotted between its kinetic energy (KE) and potential energy (PE) against its displacement d. Which one of the following represents these correctly ?

(graphs are schematic and not drawn to scale)

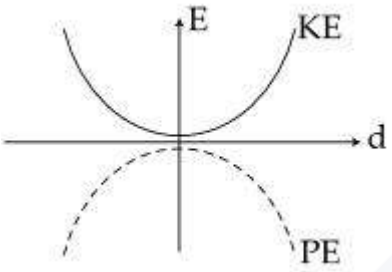
Option 1:



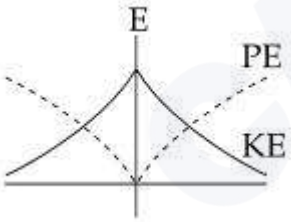
Option 2:



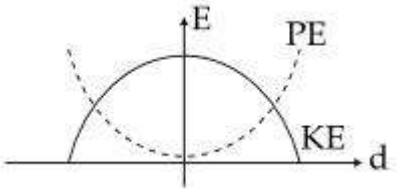
Option 3:



Option 4:



Correct Answer:



Solution:
As we learnt in

Kinetic energy in S.H.M. -

$$K.E. = \frac{1}{2}mu^2$$
$$= \frac{1}{2}m\left(A^2 - x^2\right)\omega^2$$

- wherein

$$K.E. = \frac{1}{2}k\left(A^2 - x^2\right)$$
$$k = m\omega^2$$

For a simple pendulum variation K.E. and P.E. with displacement d is

$$K.E. = \frac{1}{2}m\omega^2(A^2 - d^2)$$

$$P.E. = \frac{1}{2}m\omega^2 d^2$$

if d = 0 $K.E. = \frac{1}{2}m\omega^2 A^2$ P.E.= 0

if $d \pm A$ K.E. = 0 $P.E. = \frac{1}{2}m\omega^2 A^2$

$\therefore$ Graph 2 represents the variation correctly.

Correct option is 2.

Q. 25 Question contain Statement-1 and Statement-2. Of the four choices given after the statements, choose the one that best describes the two statements.

Statement-1 : When ultraviolet light is incident on a photocell, its stopping potential is V_0 and the maximum kinetic energy of the photoelectrons is K_{max}. When the ultraviolet light is replaced by X-rays, both V_0 and K_{max} increase.

Statement-2 : Photoelectrons are emitted with speeds ranging from zero to a maximum value because of the range of frequencies present in the incident light.

Option 1:
Statement-1 is true, Statement-2 is false.

Option 2:
Statement-1 is true, Statement-2 is true; Statement-2 is the correct explanation of Statement-1.

Option 3:
Statement-1 is true, Statement-2 is true; Statement-2 is not the correct explanation of Statement-1.

Option 4:
Statement-1 is false, Statement-2 is true.

Correct Answer:
Statement-1 is true, Statement-2 is false.

Solution:
As we learnt in

Conservation of energy -

$$h\nu = \phi_0 + \frac{1}{2}mv_{max}^2$$

$$h\nu = h\nu_0 + \frac{1}{2}mv_{max}^2$$

$$h\left(\nu - \nu_0\right) = \frac{1}{2}mv_{max}^2$$

$where, h-Plank'sconstant\ \nu-Frequency\ \nu_0-threshold\ frequency\ \phi_0-workfunction$

From Einstein's photoelectric equation

$eV_0 = h\nu - \phi$ (1)

Also $eV_0 = K_{max}$ (2)

When we increase energy of photon (i.e. moving from ultraviolet to X-ray)

V_0 increases and hence K_{max} also increases.

So Statement (1) is correct.

Statement (2) is wrong as speed of electron varies because of its collision inside the metal before its emission.

Correct answer is option1.

Q. 26 A beam of electrons accelerated by a large potential difference V is made to strike a metal target to produce X-rays. For which of the following values of V, the resulting X-rays have the lowest minimum wave length:

Option 1:
10 KV

Option 2:
20 KV

Option 3:
30 KV

Option 4:
40 KV

Correct Answer:
40 KV

Solution:
As we learnt in

Continuous x-ray -

$$\lambda^{min} = \frac{hc}{ev}$$

- wherein

Also called cutoff wavelength . All other wavelength are greater than this.

For continuous X-Ray

$$\lambda_{min} = \frac{hc}{eV}$$

$$\therefore \lambda_{min} \propto \frac{1}{V}$$

$\therefore \lambda_{min}$ will be lowest for highest value of applied potential.

V=40 KV

Q. 27 Which of the following is true for step down transformer?

Option 1:
$V_S > V_P$

Option 2:
$N_S > N_P$

Option 3:
$E_S > E_P$

Option 4:
$i_S > i_P$

Correct Answer:
$i_S > i_P$

Solution:
As we learnt

Step down transformer If decrease voltage and increase current -

$\varepsilon_s < \varepsilon_P$

-

In a transformer, $\frac{V_S}{V_P} = \frac{i_P}{i_S}$

In step down transformer $V_P > V_S$

$\Rightarrow i_P < i_S$

Q. 28 An e.m.f. of 5 millivolt is induced in a coil when in a nearby placed another coil, the current changes by 5 ampere in 0.1 second. The coefficient of mutual induction between the two coils will be :

Option 1:
1 Henry

Option 2:
0.1 Henry

Option 3:
0.1 millihenry

Option 4:
0.01 millihenry

Correct Answer:
0.1 millihenry

Solution:
As we learnt in

According to Faraday's Second Law -

$$\varepsilon_2 = -N_2\frac{d\phi_2}{dt} = -M\frac{dI_1}{dt}$$

-

$$\varepsilon = M \cdot \frac{dI}{dt} \Rightarrow 5mv = M \times \left(\frac{5}{0.1}\right)$$

$$M = 0.1mH$$

Q. 29 A body mass m = 10 kg is attached to one end of a wire of length 0.3m. The maximum angular speed (in rad s^{-1}) with which it can be rotated about its other end in space station is (Breaking stress of wire $= 4.8 \times 10^7 Nm^{-2}$ and area of cross-section of the wire $= 10^{-2}cm^2$) is:

Option 1:
4

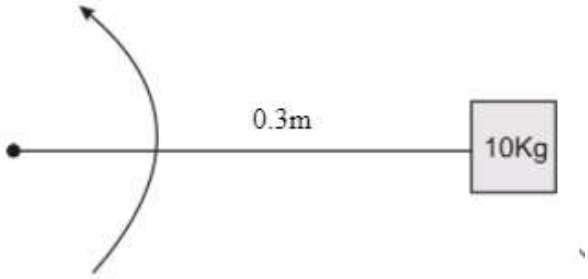
Option 2:
8

Option 3:
6

Option 4:
1

Correct Answer:
4

Solution:



$$\frac{F}{A} = \frac{mv^2}{lA}$$

$$\Rightarrow v = \sqrt{\frac{lF}{m}} = \sqrt{\frac{0.3}{10} \times 4.8 \times 10^7 \times 10^{-6}}$$

$$= \sqrt{3 \times 48 \times 10^4 \times 10^{-6}} = 1.2\text{m/s}$$

$$\omega = \frac{v}{l} = \frac{1.2}{0.3} = 4\text{rad/s}$$

the correct option is (1).

Q. 30 A thin lens made of glass (refractive index = 1.5) of focal length $f = 16\ cm$ is immersed in a liquid of refractive index 1.42. If its focal length in liquid is f_l then the ratio f_l/f is closets to the integer:

Option 1:
9

Option 2:
1

Option 3:
5

Option 4:
17

Correct Answer:
9

Solution:

$$\frac{1}{f_a} = \left(\frac{\mu_g}{\mu_a} - 1\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

$$\frac{1}{f_l} = \left(\frac{\mu_g}{\mu_l} - 1\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

$$\Rightarrow \frac{f_a}{f_l} = \frac{\left(\frac{\mu_g}{\mu_l} - 1\right)}{\left(\frac{\mu_g}{\mu_a} - 1\right)} = \frac{\left(\frac{1.50}{1.42} - 1\right)}{\left[\frac{1.50}{1} - 1\right]} = \frac{0.08}{(1.42)(0.5)}$$

$$\frac{f_l}{f_a} = \frac{(1.42)(0.5)}{0.08} = 8.875 \approx 9$$

Hence the correct option is (1).

Chemistry

Q. 1 Organic farming involves use of

Option 1:
Manures

Option 2:
biofertilizer

Option 3:
Pesticides

Option 4:
Both 1 & 2

Correct Answer:
Both 1 & 2

Solution:
Organic farming involves the use of biofertilizers, manures, and biological controls.

Hence, the option number (4) is correct.

Q. 2 4L of 0.02 M aqueous solution of Nacl was diluted by adding one litre of water. The molarity of the resultant solution is

Option 1:
0.004

Option 2:
0.008

Option 3:
0.012

Option 4:
0.016

Correct Answer:
0.016

Solution:
As we learnt in

Molarity -

$$Molarity = \frac{Moles\ of\ solute}{Vol.of\ solution(L)}$$

-

Number of moles of NaCl = 4 x 0.02 = 0.08

Total final volume = 5 L

M = 0.08 / 5 = 0.016 M

Q. 3 The gas leaked from a storage tank of the Union Carbide plant in Bhopal gas tragedy was:

Option 1:
Phosgene

Option 2:
Methyl isocyanate

Option 3:
Methylamine

Option 4:
Ammonia

Correct Answer:
Methyl isocyanate

Solution:
The gas leaked in Bhopal gas tragedy was Methyl Isocyanate.

Therefore, **Option(2) is correct**

Q. 4 Acetyl bromide reacts with excess of CH_3MgI followed by treatment with a saturated solution of NH_4Cl gives

Option 1:
acetone

Option 2:
acetamide

Option 3:
2-methyl-2-propanol

Option 4:
acetyl iodide.

Correct Answer:
2-methyl-2-propanol

Solution:
As we learnt in

Reaction of Grignard reagent with Alcohol -

Alkane is obtained.

- wherein

$$CH_3COBr \xrightarrow[(ii)staurated\ solution\ of\ NH_4CI]{(i)excess\ CH_3MgI} 2methyl-2-propanol$$

Q. 5 When sodium hypobromide reacts with weakly electropositive metal to liberate :

Option 1:
H_2 gas

Option 2:
O_2 gas

Option 3:
H_2O vapours

Option 4:
All of these

Correct Answer:
H_2 gas

Solution:
As we learnt ,

Reaction of NaOH with metals -

Weakly electro-positive metals dissolve in NaOH solution to liberate hydrogen

- wherein

$$M + 2NaOH \rightarrow Na_2MO_2 + H_2$$

Where M=Zn, Al, Sn

$$M + 2NaOH \rightarrow Na_2MO_2 + H_2 \uparrow$$

M $\rightarrow$ weak electropositive metal

Therefore, **option (1) is correct.**

Q. 6 Which of the following effects are caused by soil pollution?

Option 1:
decrease in soil fertility

Option 2:
increase in soil fertility

Option 3:
decrease in growth & yield of plants

Option 4:
Both 1 & 3

Correct Answer:
Both 1 & 3

Solution:
As we learnt

Harmful effects of soil pollution -

Affects the growth and yield of plants .
Soil fertility decreases.
Harmful materials passes through the tropic levels, increasing rate of mortality and extinction.
Affect human health.

Q. 7 The most basic oxide is

Option 1:
MnO

Option 2:
$\mathrm{MnO_2}$

Option 3:
$\mathrm{Mn_2O_6}$

Option 4:
$\mathrm{Mn_2O_7}$

Correct Answer:
MnO

Solution:
As we have learnt,

On decreasing oxidation number of central atom, basic strength increases.

Order of basic strength : $\mathrm{MnO} > \mathrm{MnO_2} > \mathrm{Mn_2O_6} > \mathrm{Mn_2O_7}$

Therefore, **option (1) is correct**

Q. 8 If a polythene sample contains two monodisperse fractions in the ratio 2:3 with degree of polymerization 100 and 200, respectively, then its weight average molecular weight will be :

Option 1:
4900

Option 2:
4600

Option 3:
4300

Option 4:
5200

Correct Answer:
4900

Solution:
Given,
Degree of polymerization of first polymer =100
Degree of polymerization of second polymer =200
$n_1 = 2$
$n_2 = 3$
Here the polymer is polythene which has monomer ethylene with molecular mass 28,
Now,
The degree of polymerization is given as:

$$\mathrm{DP} = \frac{\text{Molar mass of polymer}}{\text{molar mass of monomer}}$$

Thus,
Molar mass of first polymer

$$M_1 = 100 \times 28 = 2800 \text{ g/mol}$$

Molar mass of second polymer

$$M_1 = 200 \times 28 = 5600 \text{ g/mol}$$

Now, The weight average molecular weight is given as:

$$\overline{M}_w = \frac{\sum n_i M_i^2}{\sum n_i M_i}$$

Thus, putting all the values we get,

$$\overline{M}_w = \frac{n_1 M_1^2 + n_2 M_2^2}{n_1 M_1 + n_2 M_2}$$

$$\overline{M}_w = \frac{2(2800)^2 + 3(5600)^2}{2 \times 2800 + 3 \times 5600} = 4900 \text{ g/mol}$$

Option 1 is correct.

Q. 9 The pH of rain water, is approximately :

Option 1:
6.5

Option 2:
7.5

Option 3:
5.6

Option 4:
7.0

Correct Answer:
5.6

Solution:
The pH of rainwater is approximately 5.6.

Clean, normal rain has a pH of about 5.6. This is because it reacts with carbon dioxide in the atmosphere and forms mildly acidic carbonic acid.

Hence, the option number (3) is correct.

Q. 10 Which of the following is not applicable to chemisorption?

Option 1:
Effect of pressure is given by freundlich adsorption isotherm.

Option 2:
There is a formation of monomolecular layer

Option 3:
it occurs at lower temperature

Option 4:
It involves the formation of chemical bond.

Correct Answer:
Effect of pressure is given by freundlich adsorption isotherm.

Solution:
The effect of pressure given by Freundlich adsorption isotherm is applicable for Physical Adsorption and not Chemical Adsorption.

Hence, **the correct answer is Option (1).**

Q. 11 What will be the emf for the given cell

$$\mathrm{Pt|H_2\,(P_1)\,|H^+_{aq}\mid H_2\,(P_2)\mid Pt}$$

Option 1:
$\frac{RT}{F}\ln\frac{P_1}{P_2}$

Option 2:

$\frac{RT}{2F}\ln\frac{P_1}{P_2}$

Option 3:

$\frac{RT}{F}\ln\frac{P_2}{P_1}$

Option 4:

$\frac{RT}{2F}\ln\frac{P_2}{P_1}$

Correct Answer:

$\frac{RT}{2F}\ln\frac{P_1}{P_2}$

Solution:

Let's break the reaction into half cells.

Anode: $H_2(P_1) \rightarrow 2H^+ + 2e^-, E^0 = 0$

Cathode: $2H^+ + 2e^- \rightarrow H_2\ (P_2), E_0 = 0$

The net cell reaction can be written as

$$H_2(P_1) \longrightarrow H_2(P_2)$$

According to the Nernst equation, we have

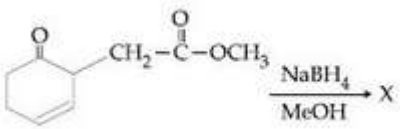
$$E_{cell} = E^0_{cell} - \frac{RT}{2F}\ln\left(\frac{P_2}{P_1}\right)$$

now, since the given cell is a concentration cell, $E^0_{cell} = 0$

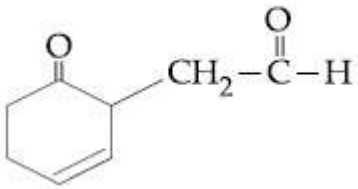
$$E_{cell} = \frac{-RT}{2F}\ln\left(\frac{P_2}{P_1}\right) = \frac{RT}{2F}\ln\left(\frac{P_1}{P_2}\right)$$

The correct option is 2.

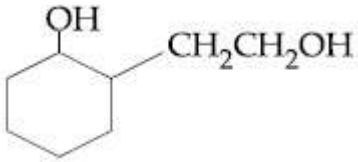
Q. 12 The major product 'X' formed in the following reaction is:



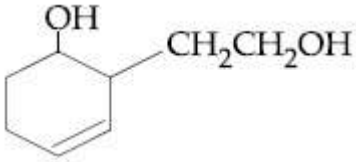
Option 1:



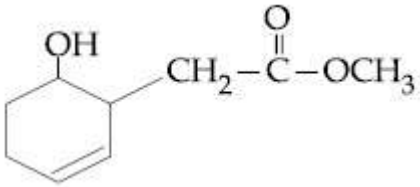
Option 2:



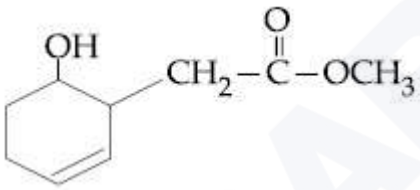
Option 3:



Option 4:



Correct Answer:



Solution:

$NaBH_4$ does not reduce esters and carbon-carbon double bonds. It is a carbonyl specialist

Therefore, **option (4) is correct.**

Q. 13 Which of the following has highest dissociation constant?

Option 1:

H_2O

Option 2:

H_2S

Option 3:
H_2Se

Option 4:
H_2Te

Correct Answer:
H_2Te

Solution:
As we learnt

Acidic nature of hydrides of oxygen family -

The hydrides of this group behave as diprotic acids in aqueous solution

- wherein

The acidic character increasing from H_2S to H_2T_e when H_2O is normal

H_2T_e is the strongest acid among the given option . Stronger the acid higher the dissociation constant value

---

Q. 14 The coagulating power of electrolytes having ions Na^+, Al^{3+} and Ba^{2+} for arsenic sulphide sol increases in the order:

Option 1:
$Al^{3+} < Na^+ < Ba^{2+}$

Option 2:
$Al^{3+} < Ba^{2+} < Na^+$

Option 3:
$Na^+ < Ba^{2+} < Al^{3+}$

Option 4:
$Ba^{2+} < Na^+ < Al^{3+}$

Correct Answer:
$Na^+ < Ba^{2+} < Al^{3+}$

Solution:
As discussed in

According to to Hardy Schulze Rule greater the charge on cation, greater is its coagulating power for negatively charged Arsenic Sulphide solution.

Hence $Na^{+} < Ba^{2+} < Al^{3+}$

Q. 15 Which one of the following shows correct decreasing order of ionistaion energy of alkaline earth metals ?

Option 1:
Mg>Be >Ca >Ba

Option 2:
Mg> Be> Ba> Ca

Option 3:
Be>Mg >Ca >Ba

Option 4:
Be> Mg> Ba> Ca

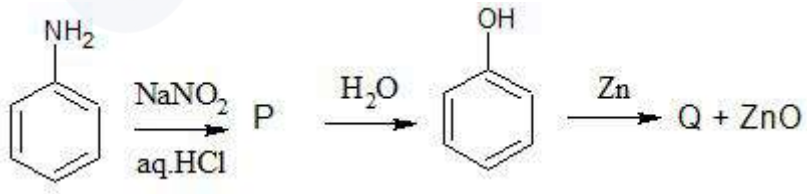
Correct Answer:
Be>Mg >Ca >Ba

Solution:
As we have learnt,

Ionistaion energy decreases as we move down in a group . This is due to an increase in the size of the atom.

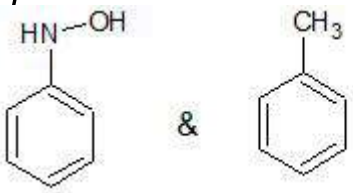
Therefore, **option(3) is correct.**

Q. 16

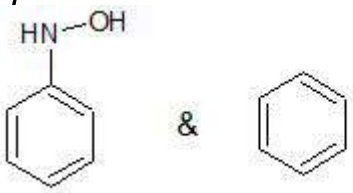


Identify P & Q

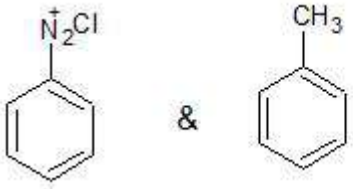
Option 1:



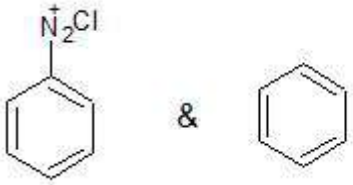
Option 2:



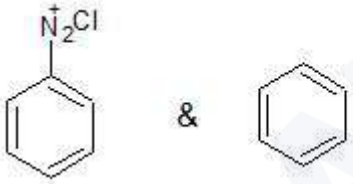
Option 3:



Option 4:

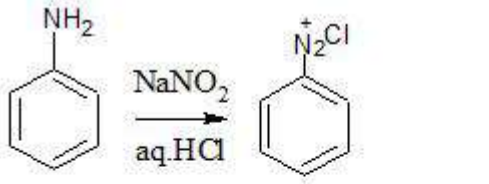


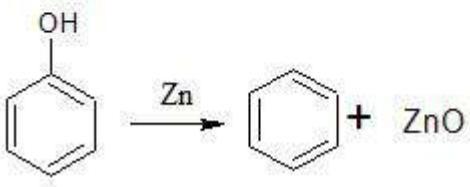
Correct Answer:



Solution:

As we learned





Therefore, **option (4) is correct.**

Q. 17 The number of mole present in 2 litre of 0.5 M NaOH is :

Option 1:
2

Option 2:
1

Option 3:
0.1

Option 4:
0.5

Correct Answer:
1

Solution:
As we learnt in

Molarity -

Molarity (M) = (Number of moles of solute)/(volume of solution in litres)

- wherein

It is defined as the number of moles of the solute in 1 litre of the solution.

$$Molarity = \frac{n}{v}$$

$$=> n = 0.5M \times 2l$$

$$=> 1.0$$

Q. 18 Solubility of a gas dissolved in a liquid is affected by

Option 1:
Nature of solute and solvent

Option 2:
Rate at which the gas dissolves

Option 3:
Temprature

Option 4:
both a and c

Correct Answer:
both a and c

Solution:
As we have learned

Dissolution of Gases in Liquid -

$$e.g.\ CO_2(gas) \rightleftharpoons CO_2(in\ solution)$$

There is equilibrium between the molecules in the gaseous state and the molecules dissolved in the liquid.

-

Solubility of gas in a liquid is not affected by the rate at which it gets disolved in a liquid

---

Q. 19 The molecular orbital electronic configuration of O_2 is represented as follows:

Option 1:
$\sigma 1s^2 \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2s^2 \sigma 2p_x^2 \pi 2p_x^2 \pi 2p_y^2 \pi^* 2p_x^1 \pi^* 2p_y^1$

Option 2:
$\sigma 1s^2 \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2s^2 \sigma 2p_z^2 \pi 2p_x^2 \pi 2p_y^2 \pi^* 2p_x^1 \pi^* 2p_y^1 \sigma^* 2p_z$

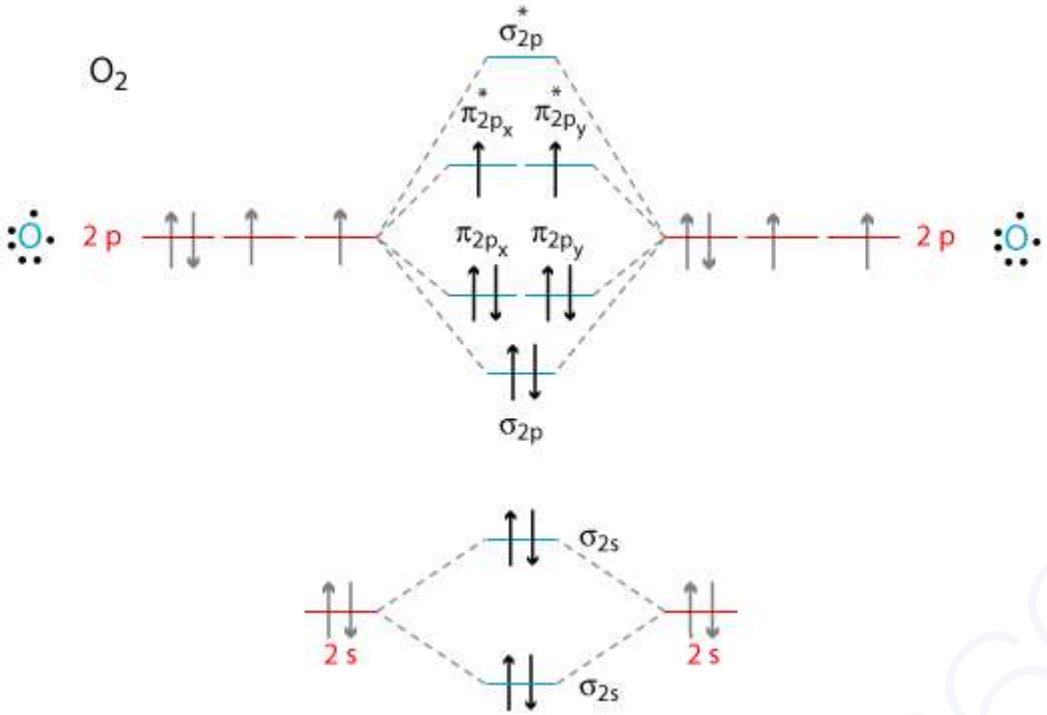
Option 3:
$\sigma 1s^2 \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2s^2 \pi 2p_x^2 \pi 2p_y^2 \sigma 2p_z^2 \pi^* 2p_x^1 \pi^* 2p_y^1$

Option 4:
$\sigma 1s^2 \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2s^2 \pi 2p_x^2 \pi 2p_y^2 \sigma 2p_z^2 \pi^* 2p_x^1 \pi^* 2p_y^1 \sigma^* 2p_z$

Correct Answer:
$\sigma 1s^2 \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2s^2 \sigma 2p_z^2 \pi 2p_x^2 \pi 2p_y^2 \pi^* 2p_x^1 \pi^* 2p_y^1 \sigma^* 2p_z$

Solution:
Electronic configuration of molecules having electrons greater than 14 is:

$$\sigma 1s\ \sigma^* 1s\ \sigma 2s\ \sigma^* 2s\ \sigma 2p_z\ \pi 2p_x\ \pi 2p_y\ \pi^* 2p_x\ \pi^* 2p_y\ \sigma^* 2p_z$$

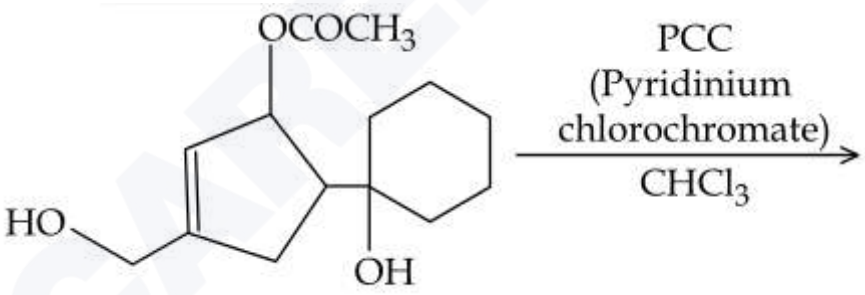


Since the total number of electrons in oxygen molecule is 16, the molecular orbital electronic configuration would be:

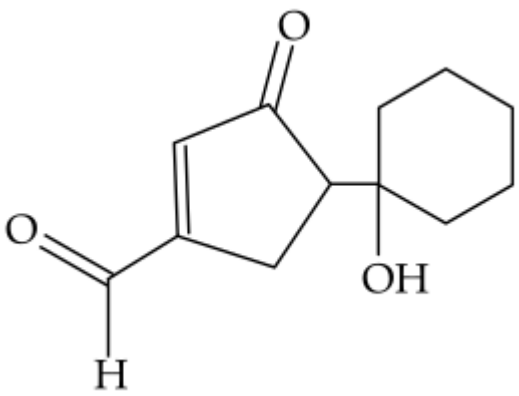
$$\sigma 1s^2\ \sigma^* 1s^2\ \sigma 2s^2\ \sigma^* 2s^2\ \sigma 2p_z^2\ \pi 2p_x^2\ \pi 2p_y^2\ \pi^* 2p_x^1\ \pi^* 2p_y^1$$

Hence, option number (2) is correct.

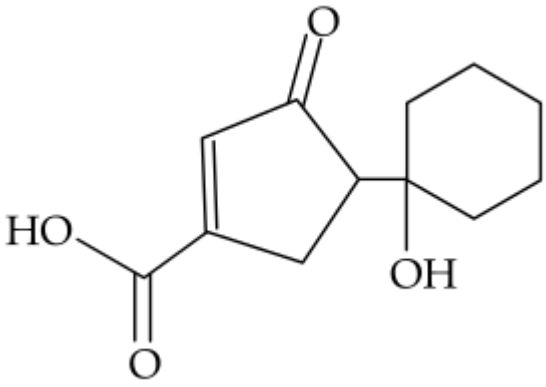
Q. 20 The major product formed in the following reaction is :



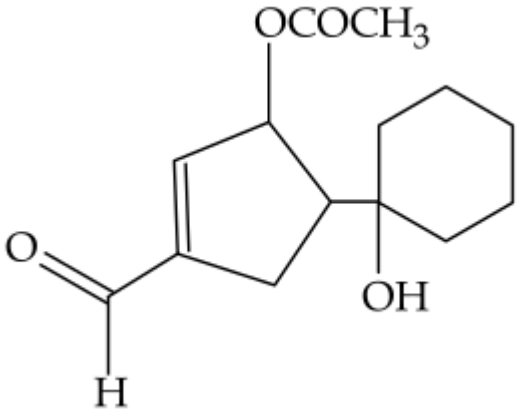
Option 1:



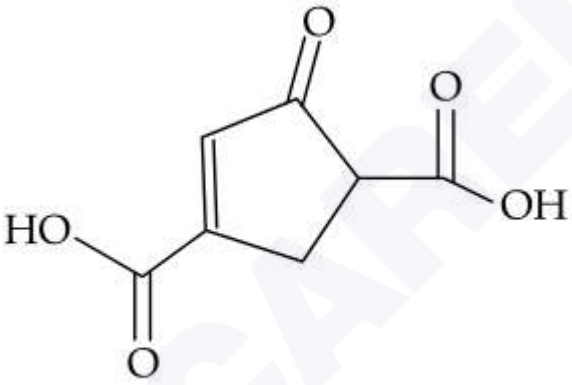
Option 2:



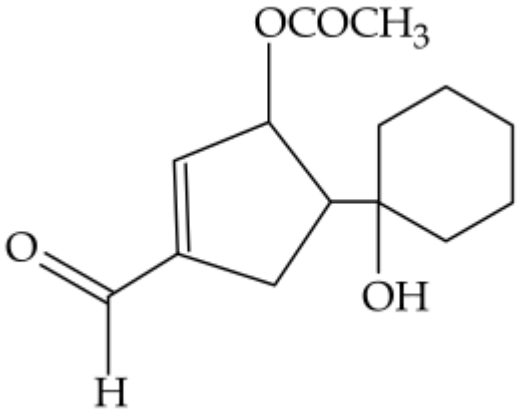
Option 3:



Option 4:



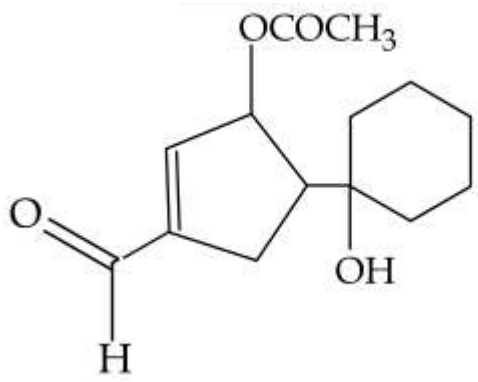
Correct Answer:



Solution:
As we learnt,

PCC in $CHCl_3$ causes oxidation of primary and secondary alcohols to form aldehydes and ketones respectively.

The product obtained is



Hence, **the correct answer is Option (3).**

Q. 21 Which one of the following statements is not true?

Option 1:
The conjugate base of $H_2PO_4^-$ is HPO_4^{2-}

Option 2:
$pH + pOH = 14 \; for \; all \; aqueous \; solutions.$

Option 3:
$The \; pH \; of \; 1 \times 10^{-8} M \; HCL \; is \; 8$

Option 4:
96,500 coulombs of electricity when passed through a $CuSO_4$ solution deposits 1 gram equivalent of copper at the cathode.

Correct Answer:
$The \; pH \; of \; 1 \times 10^{-8} M \; HCL \; is \; 8$

Solution:
Value of pH -

Acidic solution has pH < 7

Basic solution has pH > 7

Neutral solution has pH = 7

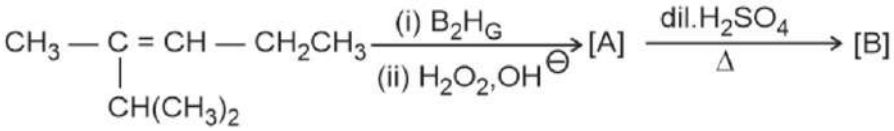
pH of acid cannot exceed 7 Here we should also consider $\left[H^{+}\right]$ that comes from H_2O

$$\text{Now } \left[\mathrm{H}^{+}\right] = \left[\mathrm{H}^{+}\right]_{\text{from HCl}} + \left[\mathrm{H}^{+}\right]_{\text{from } \mathrm{H_2O}}$$

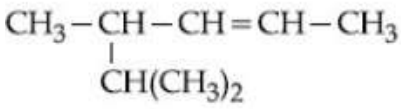
$$[\mathrm{H}]^{+} = 10^{-8} + 10^{-7}$$
$$[\mathrm{H}]^{+} = 10^{-8} + 10 \times 10^{-8}$$
$$[\mathrm{H}]^{+} = 11 \times 10^{-8}$$

$$\therefore pH = -\log\left(11 \times 10^{-8}\right) = 6.9587$$

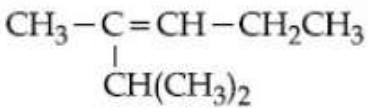
Q. 22 The major product $[B]$ in the following sequence of reaction is :



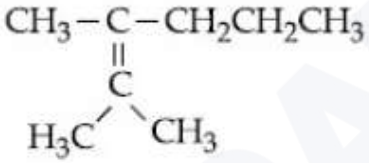
Option 1:



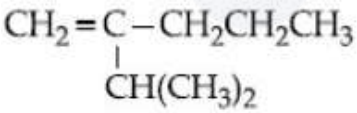
Option 2:



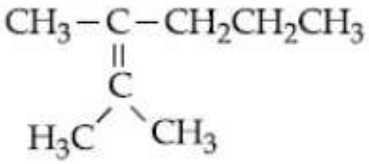
Option 3:



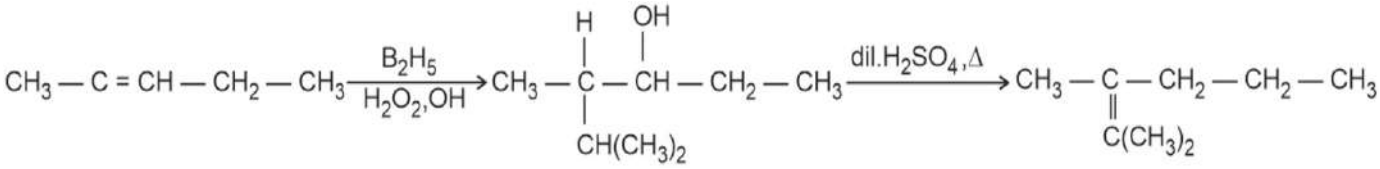
Option 4:



Correct Answer:



Solution:



Therefore, **Option(3) is correct.**

Q. 23 Which of the following sodium fusion extract of organic compound gives brilliant violet colour with sodium nitroprusside solution?

Option 1:
Urea

Option 2:
Thiourea

Option 3:
Duiline

Option 4:
Benzoic acid

Correct Answer:
Thiourea

Solution:
As we learnt

Sodium Fusion Extract -

A small piece of sodium metal is heated with an organic compound for 2-3 minutes.

- wherein

The red hot tube is plunged into the distilled water after filtering this solution. It is known as sodium fusion extract

Sodium extract of organic compound gives violet colour with sodium nitroprusside solution when it contains sulphur. Thiourea$\Rightarrow NH_2CSNH_2$ contains sulphur hence it will give brilliant violet colour when given treatments.

Hence, the option number (2) is correct.

Q. 24 A water sample has ppm level concentration of the following anions

$$F^- = 10;\ SO_4^{2-} = 100;\ NO_3^- = 50$$

The anion/anions that make/makes the water sample unsuitable for drinking is/ are :

Option 1:
Only F^-

Option 2:
Only SO_4^{2-}

Option 3:
Only NO_3^-

Option 4:
Both SO_4^{2-} and NO_3^-

Correct Answer:
Only F^-

Solution:
The concentration of F^- above 2 PPM in drinking water causes Brown mottling of teeth.

The correct option is 1.

Q. 25 During the detection of Hg_2^{2+} with HCl, when Ammonia solution is added to the precipitate, there is a black precipitate formed. This black coloration is due to

Option 1:
$Hg(NH_2)Cl$

Option 2:
Hg

Option 3:
Hg_2Cl_2

Option 4:
None of these

Correct Answer:
Hg

Solution:
As we have learnt,

$Hg_2^{2+}$is precipitated with HCl in the form of white precipitate. Upon adding Ammonia solution to the precipitate, black coloration is obtained. This is due to the formation of Hg obtained as a result of disproportionation of Hg_2^{2+}. The other product is Mercuric amidochloride. The reaction occurs as

$$Hg_2Cl_2 + NH_3 \rightarrow Hg(NH_2)Cl + Hg(black\ ppt)$$

Black precipitate confirms the presence Hg_2^{2+}

Hence, the correct answer is Option (2)

Q. 26 1-Butyne $\xrightarrow{2[H]} A \xrightarrow[Benzoyl Peroxide]{Hcl\ in} B \xrightarrow[KOH]{Alc} C,\ C\ is$

Option 1:
1-butene

Option 2:
2-butene

Option 3:
1-butyne

Option 4:
2-butyne

Correct Answer:
2-butene

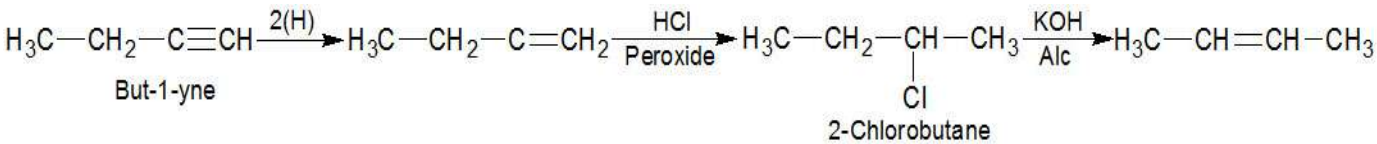
Solution:
As we learnt in

Reaction of alkyl halide with KOH (alc) -

β- elimination reaction take place and produces alkenes.

- wherein

$$CH3CH2Br + KOH(alc.) \rightarrow H2C = CH2 + KBr + H2O$$



Q. 27 Calgon is

Option 1:
Sod aluminium silicate

Option 2:
Calcium silicate

Option 3:
Polyphosphate

Option 4:
Poly sulphates

Correct Answer:
Polyphosphate

Solution:
As we lerant in

Permanent Hardness -

Such hardness is due to calcium or magnesium chloride and sulphate.

- wherein

It can be removed by

1) Calgon's method

2) Ion exchange method

Calgon is the common name for the complex salt Sodium hexa meta phosphate $(NaPO_3)_6$ .So it is ploy phosphate.

Q. 28 Bond distance in HF is $9.17 \times 10^{-11} m.$ Dipole moment of HF is $6.104 \times 10^{-30} cm.$ The percent ionic character in HF will be :

(electron charge =$1.60 \times 10^{-19} C$)

Option 1:
61.0%%

Option 2:
38.0%%

Option 3:
35.5%

Option 4:
41.5%

Correct Answer:
41.5%

Solution:
Given, $e = 1.60 \times 10^{-19}\text{C},\ \text{d} = 9.17 \times 10^{-11}\text{m}$ From

$$\mu = e \times d\mu = 1.60 \times 10^{-19} \times 9.17 \times 10^{-11} = 14.672 \times 10^{-30}$$

$$\%\ \text{ionic character} = \frac{\text{Observed dipole moment}}{\text{Dipole moment for 100}} = 41.5\%$$

Q. 29 Poly-condensation of phenols occurs in:

Option 1:
Schotten-Baumann Reaction

Option 2:
Perkins reaction

Option 3:
Baekeland Lederer Manasse reaction

Option 4:
Aldol condensation

Correct Answer:
Baekeland Lederer Manasse reaction

Solution:
As we learned

Lederer Manasse reaction -

Product formed is bakellite.

- wherein

In Backland Lederer Manasse reaction, synthesis of phenol-formaldehyde resin occurs by the polycondensation of phenols in excess amounts of formaldehyde.

Therefore, **Option(3) is correct**

Q. 30 Calculate the degree of hydrolysis of 0.005 M K_2CrO_4. K_2 = 5.0 × 10^{-7} for H_2CrO_4. (It is essentially strong for first ionization).

Option 1:
2×10^{-7}

Option 2:
4×10^{-5}

Option 3:
2×10^{-3}

Option 4:
2×10^{3}

Correct Answer:
2×10^{-3}

Solution:
According to the question, we have to only assume the first hydrolysis of the Chromate ion. So the reaction will be

$$\mathrm{CrO_4^{2-} + H_2O(l) \rightleftharpoons HCrO_4^{-} + OH^{-}}$$

$$\mathrm{K_h = \frac{K_w}{K_{a_2}} = \frac{10^{-14}}{5 \times 10^{-7}} = 2 \times 10^{-8}}$$

Now,

$$\mathrm{K_h = c \times h^2 \Rightarrow h = \sqrt{\frac{K_h}{c}}}$$

$$\mathrm{\therefore h = \sqrt{\frac{2 \times 10^{-8}}{0.005}} = 2 \times 10^{-3}}$$

Therefore, **option(3) is correct**

Maths

Q. 1 If A is a skew symmetric matrix and (I + A) is non singular matrix then B = (I – A) $(I + A)^{-1}$ is

Option 1:
orthogonal matrix

Option 2:
symmetric matrix

Option 3:
skew symmetric matrix

Option 4:
none of these

Correct Answer:
orthogonal matrix

Solution:
As we have learned

Skew symmetric matrix -

If $A = [a_{ij}]$ and $a_{ij} = -a_{ji}$ for all i and j

- wherein

Now,

$$B' = ((I-A)(I+A)^{-1})' = ((I+A)^{-1})'(I-A)'$$

$$= ((I+A)')^{-1}(I-A)'$$

$$= (I-A)^{-1}(I+A)$$

$$Hence,$$

$$BB^T = (I-A)(I+A)^{-1}(I-A)^{-1}(I+A) = I.I = I$$

$$Hence, BB^T = I.$$

$$Hence, \text{B is an orthogonal matrix.}$$

Q. 2 Which of the following points lie outside $y^2 = 8x$?

Option 1:
(5,5)

Option 2:
(8,8)

Option 3:
(10,10)

Option 4:
None of these

Correct Answer:
(10,10)

Solution:
Given parabola is

$S : y^2 - 8x = 0$

For (5,5)

$S_1 : 5^2 - 8 \times 5 = -15 < 0$

So it lies inside the parabola

For (8,8)

$S_1 : 8^2 - 8 \times 8 = 0$

So it lies on the parabola

For (10,10)

$S_1 : 10^2 - 8 \times 10 = 20 > 0$

So it lies outside the parabola

Q. 3 If f is a one one function but g is a many one fuction where $f : A \to B$ and $g : B \to C$ then gof is a

Option 1:
one one function

Option 2:
many one fuction

Option 3:
not an fuction

Option 4:
can't say

Correct Answer:
can't say

Solution:
As we learned

Property of Composition of Functions -

If f: A → B and g: B → C are one-one, then g o f: A → C is also one-one
If f: A → B and g: B → C are onto, then g o f: A → C is also onto
If g o(f) is one-one, Then f is one-one.
If g o(f) is onto, Then g is onto.

We cannot certainly say as it will depend the two functions and also the sets A,B and C.

Q. 4 Find the equation to the tangent of circle $x^2 + y^2 = 26$ at the point (5,1)

Option 1:
x + 5y = 26

Option 2:
5x + y = 26

Option 3:
$x + 5y = \sqrt{26}$

Option 4:
$5x + y = \sqrt{26}$

Correct Answer:
5x + y = 26

Solution:
Here $x_1 = 5$, $y_1 = 1$

So equation of tangent to given circle at (5,1) is

$xx_1 + yy_1 = 26$

Thus ,we get $5x + y = 26$

Q. 5 The order and the degree of the differential equation of all ellipses with centre at the origin, major axis along x-axis and eccentricity $\frac{\sqrt{3}}{2}$ are, respectively :

Option 1:
2, 2

Option 2:
1, 1

Option 3:
2, 1

Option 4:
1, 2

Correct Answer:
1, 1

Solution:
As we learnt in

Order of a Differential Equation -

The order of a differential equation is order of highest order occuring in differential equation

- wherein

order of

$$\frac{d^2y}{dx^2}+5=0$$

is 2.

Let the equation of ellipse is

$$\frac{x^2}{a^2}+\frac{y^2}{b^2}=1 \quad but\ 1-\frac{b^2}{a^2}=\frac{3}{4}$$

$$\therefore \frac{x^2}{4b^2}+\frac{y^2}{b^2}=1 \quad \therefore \frac{b^2}{a^2}=\frac{1}{4}$$

$$\therefore x^2+4y^2=4b^2 \quad \therefore a^2=4b^2$$

$$\therefore 2x+8y.\frac{dy}{dx}=0$$

$$\therefore x+4y.\frac{dy}{dx}=0$$

$$order=1$$
$$degree=1$$

Q. 6 $f(x)=\tan x$ and $g(x)=\sec x$ both are

Option 1:
Diffrentiable at π

Option 2:
Non -Diffrentiable at π

Option 3:
Diffrentiable at $\pi/2$

Option 4:
Diffrentiable at $3\pi/2$

Correct Answer:
Diffrentiable at π

Solution:
As we have learned

Properties of differentiable functions -

Trigonometric and inverse trigonometric functions are differentiable in their respective domain.

-

$\because$ Trigonometric function are diffrentiable at points in domain so f(x) = tan x and g(x) = sec x will be diffrentiable at π , but not at $\pi/2 \ and \ 3\pi/2$

Q. 7 The trigonometric equation $sin^{-1}x = 2sin^{-1}a,$ has a solution for

Option 1:
all real values

Option 2:
$|a| < \frac{1}{2}$

Option 3:
$|a| \geqslant \frac{1}{\sqrt{2}}$

Option 4:
None of these

Correct Answer:
None of these

Solution:
As we learnt in

Domains and Ranges of Inverse Trigonometric Functions -

For $\sin^{-1} x$

Domain $\epsilon \left[-1, 1\right]$

Range $\epsilon \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$

-

$$sin^{-1}x = 2sin^{-1}a \quad .....(1)$$

For (1) to have solution,

$$-\frac{\pi}{2} \leq 2\sin^{-1} a \leq \frac{\pi}{2}$$

$$\Rightarrow -\frac{\pi}{4} \leq \sin^{-1} a \leq \frac{\pi}{4}$$

$$\Rightarrow -\sin^{-1}\frac{\pi}{4} \leq a \leq \sin\frac{-\pi}{4}$$

$$\Rightarrow -\frac{1}{\sqrt{2}} \leq a \leq \frac{1}{\sqrt{2}}$$

Thus $|a| \leq \frac{1}{\sqrt{2}}$

Also, for $\sin^{-1} a$ to be defined $|a| \leq 1$. Thus solution is $|a| \leq \frac{1}{\sqrt{2}}$

None of the solution is correct.

Q. 8 What are the coordinates of focii of hyperbola $\frac{x^2}{16} - \frac{y^2}{9} = 1$

Option 1:
$\left(\pm\sqrt{7}, 0\right)$

Option 2:
$\left(\pm\sqrt{7}/3, 0\right)$

Option 3:
$(\pm 5, 0)$

Option 4:
$(\pm 3, 0)$

Correct Answer:
$(\pm 5, 0)$

Solution:
Here a = 4, b = 3

$$e = \sqrt{1 + \frac{b^2}{a^2}} = \frac{5}{4}$$

Thus focii are $(\pm ae, 0) \Rightarrow (\pm 5, 0)$

Q. 9 If $\cos^2\theta$ = 1 then Find such θ that satisfy all values

Option 1:
$2n\pi$

Option 2:
$(2n + 1)\pi$

Option 3:
$n\pi$

Option 4:
$(2n \pm 1)\pi$

Correct Answer:
$n\pi$

Solution:
As we have learned

Results from General Solution -

$$\cos\Theta = -1 \Rightarrow \Theta = (2n + 1)\,\pi$$

$$\cos^2\theta = 1 \quad \cos\theta = 1 \;\; or \cos\theta = -1$$

$$\theta = 2n\pi \quad or\theta = (2n + 1)\pi$$

Thus θ = both odd and even multiplies of π

$$\theta = n\pi$$

Q. 10 $\int \frac{dx}{cosx - sinx}$ is equal to

Option 1:

$\frac{1}{\sqrt{2}}log\left|tan\left(\frac{x}{2}-\frac{3\pi}{8}\right)\right|+C$

Option 2:

$\frac{1}{\sqrt{2}}log\left|cot\left(\frac{x}{2}\right)\right|+C$

Option 3:

$\frac{1}{\sqrt{2}}log\left|tan\left(\frac{x}{2}-\frac{\pi}{8}\right)\right|+C$

Option 4:

$\frac{1}{\sqrt{2}}log\left|tan\left(\frac{x}{2}+\frac{3\pi}{8}\right)\right|+C$

Correct Answer:

$\frac{1}{\sqrt{2}}log\left|tan\left(\frac{x}{2}+\frac{3\pi}{8}\right)\right|+C$

Solution:

As learnt in concept

Integrals for Trigonometric functions -

$\frac{\mathrm{d}}{\mathrm{d}x}\left(-cosx\right)=sinx$

$\therefore\int sinxdx=-cosx+c$

cosx-sinx=$\sqrt{2}(\frac{1}{\sqrt{2}}cosx-\frac{1}{\sqrt{2}}sinx)$

=$\sqrt{2}cos(x+\frac{\pi}{4})$

$=\int\frac{dx}{cosx-sinx}=\int\frac{dx}{\sqrt{2}(\frac{1}{\sqrt{2}}\cos x-\frac{1}{\sqrt{2}}\sin x)}$

$\Rightarrow\frac{1}{\sqrt{2}}\int\frac{dx}{\cos(\frac{\pi}{4}+x)}$

$\Rightarrow\frac{1}{\sqrt{2}}\int\sec(\frac{\pi}{4}+x)dx=\frac{1}{\sqrt{2}}\log|\tan(\frac{x}{2}+\frac{3\pi}{8})|$

=$\frac{1}{\sqrt{2}}log\left|tan(\frac{x}{2}+\frac{3\pi}{8})\right|+C$

Q. 11 Find the conditions, if the roots of the equation $x^3 - px^2 + qx - r = 0$ are in AP?

Option 1:
$2p^3 + 9pq - 27r = 0$

Option 2:
$2p^3 - 9pq + 27r = 0$

Option 3:
$4p^3 - 9pq + 27r = 0$

Option 4:
$4p^3 + 9pq - 27r = 0$

Correct Answer:
$2p^3 - 9pq + 27r = 0$

Solution:
let the roots be a-d, a and a+d, then:

Sum of the roots = a-d + a + a+d = 3a = p ⇒ a = p/3

Since this value of a should satisfy the equation, so we put the value in equation and we get

$$\Rightarrow \left(\frac{p}{3}\right)^3 - p\left(\frac{p}{3}\right)^2 + q\frac{p}{3} - r = 0$$
$$\Rightarrow p^3 - 3p^3 + 9pq - 27r = 0$$
$$\text{or } 2p^3 - 9pq + 27r = 0$$

Correct option is (b)

Q. 12 Which of the following is NOT an event of the random experiment of rolling a die?

Option 1:
Getting a number divisible by 3.

Option 2:
Getting a multiple of 7.

Option 3:
Getting an even prime.

Option 4:
Getting an odd prime.

Correct Answer:
Getting a multiple of 7.

Solution:
As we learned

Random Experiment -

If an experiment is performed many times under similar conditions and the outcome of each time is not the same, then this experiment is called a random experiment.

Example : Tossing of a fair coin.

Since it is not possible to get a multiple of 7.

Q. 13 The integral $\int \frac{3x^{13}+2x^{11}}{(4x^4+3x^2+1)^4}dx$ is equal to

Option 1:
$$\frac{x^4}{(2x^4+3x^2+1)^3}+C$$

Option 2:
$$\frac{x^4}{6(2x^4+3x^2+1)^3}+C$$

Option 3:
$$\frac{x^{12}}{(2x^4+3x^2+1)^3}+C$$

Option 4:
$$\frac{x^{12}}{6(4x^4+3x^2+1)^3}+C$$

Correct Answer:
$$\frac{x^{12}}{6(4x^4+3x^2+1)^3}+C$$

Solution:

$$I = \int \frac{(3x^{13} + 2x^{11})dx}{(4x^4 + 3x^2 + 1)^4}$$
$$= \int \frac{(3x^{13} + 2x^{11})dx}{x^{16}(4 + 3x^{-2} + 1.x^{-4})^4}$$
$$= \int \frac{3x^{-3} + 2x^{-5}}{(4 + 3x^{-2} + x^{-4})^4} dx$$

$$Put\ 4 + 3x^{-2} + x^{-4} = t$$
$$dt = -2(3x^{-3} + 2x^{-5})dx$$

$$\therefore I = -\frac{1}{2}\int \frac{dt}{t^4} = -\frac{1}{2}(\frac{t^{-3}}{-3}) + c$$
$$= \frac{1}{6(4 + 3x^{-2} + x^{-4})^3} + c$$
$$= \frac{x^{12}}{6(4x^4 + 3x^2 + 1)^3} + c$$

Q. 14 The most general solution of $\tan\theta = -1\ \ and\ \ \cos\theta = \frac{1}{\sqrt{2}}$ is

Option 1:
$n\pi + \frac{7\pi}{4}$

Option 2:
$n\pi + (-1)^n \frac{7\pi}{4}$

Option 3:
$2n\pi + \frac{7\pi}{4}$

Option 4:
None of these

Correct Answer:
$2n\pi + \frac{7\pi}{4}$

Solution:

$\tan\theta = -1 \Rightarrow \theta = \frac{3\pi}{4}, \frac{7\pi}{4}$

$\cos\theta = \frac{1}{\sqrt{2}} \Rightarrow \theta = \frac{\pi}{4}, \frac{7\pi}{4}$

$Common\ \theta = \frac{7\pi}{4}$

As both cos and tan functions repeat after an interval of 2π, so

$General\ solution = 2n\pi + \frac{7\pi}{4}$

Q. 15 $If\ \vec{a} = 2\vec{i} + 5\vec{j}\ and\ \vec{b} = 2\vec{i} - \vec{j}$

then unit vector in the direction of $\vec{a} + \vec{b}$ is

Option 1:

$\vec{i} + \vec{j}$

Option 2:

$\sqrt{2}(\vec{i} + \vec{j})$

Option 3:

$\frac{(\vec{i} + \vec{j})}{\sqrt{2}}$

Option 4:

$\frac{(\vec{i} - \vec{j})}{\sqrt{2}}$

Correct Answer:

$\frac{(\vec{i} + \vec{j})}{\sqrt{2}}$

Solution:

As we learnt in

Unit vector -

A vector of unit magnitude in direction of a vector $\vec{A}$ is called unit vector along $\hat{a}$.

- wherein

It is denoted by $\hat{a}$.

$\vec{a} = 2i + 5j$

$\vec{b} = 2i - j$

$\vec{a} + \vec{b} = 4i + 4j$

$\frac{\vec{a} + \vec{b}}{\left|\vec{a} + \vec{b}\right|} = \frac{4(i+j)}{4\sqrt{2}} = \frac{i+j}{\sqrt{2}}$

Q. 16 If A is an 3 x 3 non - singular matrix such that AA' = A'A and B = A^{-1} A' , then BB' equals :

Option 1:
B^{-1}

Option 2:
$(B^{-1})'$

Option 3:
I + B

Option 4:
I

Correct Answer:
I

Solution:
As we learnt in

Property of Transpose -

$(AB)' = B'A'$

- wherein

A ' is the conjugate matrix of A

$\Rightarrow AA^1 = A^1A$

$and\ \beta = A^{-1}A^1 \quad (given)$

So that $BA = A^{-1}A^1A \quad [multiply\ by\ A]$

$= A^{-1}AA^1$

$= IA^1$

$= A^1$

Now, $(BA)^1 = (A^1)^1 = A$

$$A^1 B^1 = A$$
$$A^{-1} A^1 B^1 = A^{-1} A = I \quad \text{[since } A^{-1}A = I \text{ and multiply by } A^{-1}\text{]}$$
$$\beta B^1 = I$$

Q. 17 $\lim_{x \to \pi/4} (1 + \tan x)^{2\sin(\pi/4 + x)}$ equals

Option 1:
4

Option 2:
2

Option 3:
1

Option 4:
1/2

Correct Answer:
4

Solution:
As we have learned

Limit of power -

$$\lim_{x \to a} f(x)^{g(x)} = (P) \lim_{x \to a} g(x)$$

$$Where\ f(x)^{g(x)}\ does\ not\ take\ indeterminate\ form\ at\ x = a$$

- wherein

Where P is a non zero finite constant

When $x \to \pi/4$ then $(1 + \tan x) \to 2$ and $2\sin(\pi/4 + x) \to 2$

$$\therefore \lim_{x \to \pi/4} (1 + \tan x)^{2\sin(\pi/4 + x)} = 2^2 = 4$$

Q. 18 Given n(A) = 50, n(B) = 30 and n(AUB) = x such that n(A ∩ B) = 20. Find x

Option 1:
20

Option 2:
40

Option 3:
60

Option 4:
80

Correct Answer:
60

Solution:
We know,

$n (A \cup B) = n (A) + n (B) – n (A \cap B)$

$x = 50 + 30 - 20 = 60$

Q. 19 If AxB = {(1,2),(1,3),(2,2),(2,3),(3,2),(3,3)}, BxC = {(2,4),(2,5),(3,4),(3,5)} and AxC = {(1,4),(1,5),(2,4),(2,5),(3,4),(3,5)}, then find A x (B U C) = ?

Option 1:
{(2,4),(2,5),(3,4),(3,5)}

Option 2:
{(1,2),(1,3),(2,2),(2,3),(3,2),(3,3),(1,4),(1,5),(2,4),(2,5),(3,4),(3,5)}

Option 3:
{(1,2),(1,3),(1,5),(2,4),(2,5),(3,4),(3,5)}

Option 4:
{(1,2),(2,2),(2,3),(3,2),(3,3),(1,4),(1,5),(3,5)}

Correct Answer:
{(1,2),(1,3),(2,2),(2,3),(3,2),(3,3),(1,4),(1,5),(2,4),(2,5),(3,4),(3,5)}

Solution:
As in A x B, the first elements of all ordered pair belong to A, so, A = {1,2,3}

[as 1,2,3 are there in first elements of AxB]

Similarly, first elements of ordered pairs in B x C will give the set B.

So, B = {2,3}

and second elements of ordered pairs in BxC will give C.

So, C = {4,5}

Thus B U C = {2,3,4,5}

and A x (B U C) = {(1,2),(1,3),(1,4),(1,5),(2,2),(2,3),(2,4),(2,5),(3,2),(3,3),(3,4),(3,5)}

Q. 20 If $\begin{vmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix} = (a+b+c)(x+a+b+c)^2, x \neq 0 \text{ and } a+b+c \neq 0$, then x is equal to :

Option 1:
$-2(a+b+c)$

Option 2:
abc

Option 3:
$-(a+b+c)$

Option 4:
$2(a+b+c)$

Correct Answer:
$-2(a+b+c)$

Solution:
Value of determinants of order 3 -

-

$$\begin{vmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix}$$

$$R_1 \to R_1 + R_2 + R_3$$

$$= \begin{vmatrix} a+b+c & a+b+c & a+b+c \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix}$$

$$C_2 \to C_2 - C_1 \qquad C_3 \to C_3 - C_1$$

$$= (a+b+c)\begin{vmatrix} 1 & 0 & 0 \\ 2b & -(a+b+c) & 0 \\ 2c & 2c & c-a-b \end{vmatrix}$$

$= (a+b+c) \cdot (a+b+c)^2$

$=> x = 0 \ \ or \ \ -2(a+b+c)$

Q. 21 A ray of light is incident along a line which meets another line, 7x − y + 1 = 0, at the point (0, 1). The ray is then reflected from this point along the line, y + 2x = 1. Then the equation of the line of incidence of the ray of light is :

Option 1:
41x − 38y + 38 = 0

Option 2:
41x + 25y − 25 = 0

Option 3:
41x + 38y − 38 = 0

Option 4:
41x − 25y + 25 = 0

Correct Answer:
41x − 38y + 38 = 0

Solution:

$Let\ slope\ of\ incident\ ray\ is\ m$
$\therefore angle\ of\ incident\ = angle\ of\ reflection$
$\therefore \left|\frac{m-7}{1+7m}\right| = \left|\frac{-2-7}{1-24}\right| = \frac{9}{13}$
$\frac{m-7}{1+7m} = \frac{9}{13} \ \ or \ \ \frac{m-7}{1+7m} = -\frac{9}{13}$
$\Rightarrow m = -\frac{1}{2} \ or \ m = \frac{41}{38}$
$\Rightarrow (y-1) = -\frac{1}{2}(x-0) \ \ or \ \ (y-1) = \frac{41}{38}(x-0)$
$i.e. x + 2y - 2 = 0 \ or \ 38y - 41x - 38 = 0$
$ans\ is \ \ 38y - 41x - 38 = 0$

Q. 22 Evalute the integral $\int_{-4}^{4} x^2 dx$

Option 1:
$\frac{32}{3}$

Option 2:

$\frac{64}{3}$

Option 3:

$\frac{128}{3}$

Option 4:

$\frac{256}{3}$

Correct Answer:

$\frac{128}{3}$

Solution:

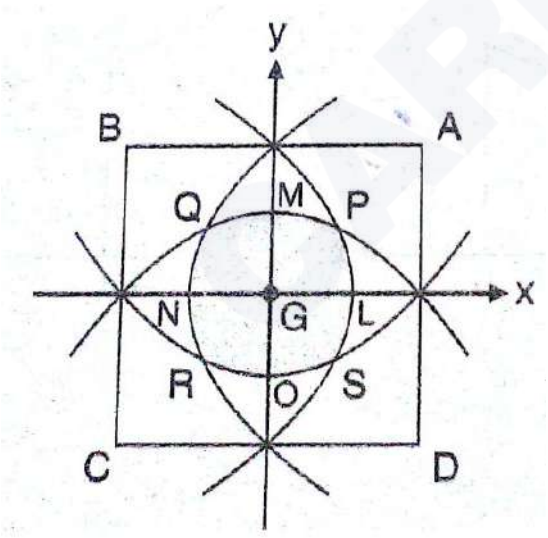
As we have learnt,

Properties of Definite Integration -

If the function $f(x)$ is symmetric in x as well as y axis, then the absolute area of the closed figure is four times the integral of the same function in any one of the quadrant.

$ar(PQRSP) = 4ar(LPMGL)$

- wherein



$$\int_{-4}^{4} x^2 dx = 2\int_{0}^{4} x^2 dx = 2\left[\frac{x^3}{3}\right]_0^4 = 2 \times \frac{64}{3} = \frac{128}{3}$$

Q. 23 The equation to the chord joining two points $(x_1, y_1)\ and\ (x_2, y_2)$ on the rectangular hyperbola $xy = c^2$ is :

Option 1:

$$\frac{x}{x_1 + x_2} + \frac{y}{y_1 + y_2} = 1$$

Option 2:

$$\frac{x}{x_1 - x_2} + \frac{y}{y_1 - y_2} = 1$$

Option 3:

$$\frac{x}{y_1 + y_2} + \frac{y}{x_1 + x_2} = 1$$

Option 4:

$$\frac{x}{y_1 - y_2} + \frac{y}{x_1 - x_2} = 1$$

Correct Answer:

$$\frac{x}{x_1 + x_2} + \frac{y}{y_1 + y_2} = 1$$

Solution:

Rectangular Hyperbola -

$$x^2 - y^2 = a^2$$

- wherein

Mid point is $M\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

$\therefore$ equation of the chord to the hyperbola $xy = c^2$

whose midpoint is M, is $\frac{x}{\frac{x_1+x_2}{2}} + \frac{y}{\frac{y_1+y_2}{2}} = 2$

$$\frac{x}{x_1 + x_2} + \frac{y}{y_1 + y_2} = 1$$

Q. 24 If y=mx+4 is a tangent to both the parabolas, $y^2 = 4x$ and $x^2 = 2by$, then b is equal to :

Option 1:
-64

Option 2:
128

Option 3:
-128

Option 4:
-32

Correct Answer:
-128

Solution:

Tangents of Parabola in Slope Form -

Tangents of Parabola in Slope Form

Equation of the tangent to the parabola $y^2 = 4ax$ at the point $P(x_1, y_1)$ is $yy_1 = 2a(x + x_1)$

m is the slope of the tangent, then

$$m = \frac{2a}{y_1} \Rightarrow y_1 = \frac{2a}{m}$$

(x_1, y_1) lies on the paarabola $y^2 = 4ax$

$$y_1^2 = 4ax_1 \Rightarrow \frac{4a^2}{m^2} = 4ax_1$$

$$\therefore \quad x_1 = \frac{a}{m^2}$$

put the value of x_1 and y_1 in the equation $yy_1 = 2a(x + x_1)$ we get

$$\Rightarrow \quad y = mx + \frac{a}{m}$$

which is equation of tangent of the parabola in slope form.

The coordinates of point of contact are

$$\left(\frac{a}{m^2}, \frac{2a}{m}\right)$$

TIP

Equation of Parabola	Point of Contact	Tangent Equation
$y^2= 4ax$	$\left(\frac{a}{m^2}, \frac{2a}{m}\right)$	$y = mx + \frac{a}{m}$
$y^2= -4ax$	$\left(-\frac{a}{m^2}, \frac{2a}{m}\right)$	$y = mx - \frac{a}{m}$
$x^2= 4ay$	$(2am, am^2)$	$y = mx - am^2$
$x^2= -4ay$	$(2am, -am^2)$	$y = mx + am^2$

-

$$y = mx - am^2$$
$$y = \frac{x}{4} + 4$$
$$y = 4x, y = mx + \frac{1}{m}$$
$$\Rightarrow m = \frac{1}{4}$$
$$y = \frac{x}{4} + 4$$

also ,

$$x^2 = 2by$$
$$y = mx - \frac{bm^2}{2}$$
$$y = \frac{x}{4} + 4$$
$$\implies \frac{bm^2}{2} = -4$$

since , $m = \frac{1}{4}$

Therefore , $b =$ **-128**

Correct Option (3)

Q. 25 Let $y = y(x)$ be the solution of the fifferential equation,

$$\frac{\mathrm{d}y}{\mathrm{d}x} + ytanx = 2x + x^2tanx, x\epsilon(\frac{-\pi}{2}, \frac{\pi}{2}),$$

such that $y(0) = 1$. Then :

Option 1:

$$y(\frac{\pi}{4})+y(\frac{-\pi}{4})=\frac{\pi^2}{2}+2$$

Option 2:

$$y'(\frac{\pi}{4})+y'(\frac{-\pi}{4})=-\sqrt{2}$$

Option 3:

$$y(\frac{\pi}{4})-y(\frac{-\pi}{4})=\sqrt{2}$$

Option 4:

$$y'(\frac{\pi}{4})-y'(\frac{-\pi}{4})=\pi-\sqrt{2}$$

Correct Answer:

$$y'(\frac{\pi}{4})-y'(\frac{-\pi}{4})=\pi-\sqrt{2}$$

Solution:

Linear Differential Equation -

$$\frac{dy}{dx}+Py=Q$$

- wherein

P, Q are functions of x alone.

Linear Differential Equation -

Multiply by $e^{\int P\,dx}$ which is the Integrating factor (IF)

- wherein

P is the function of x alone

$$\frac{\mathrm{d}y}{\mathrm{d}x}+ytanx=2x+x^2tanx,$$

$$I.F.=e^{\int tanxdx}$$

$$I.F.=e^{\int tanxdx}=e^{\ln secx}=secx$$

Solution of DE

$$y\,secx=\int(2x+x^2tanx)secx\,dx+C$$

$$y\ secx = \int (2xsecx\ dx) + \int x^2 tanx\ secx\ dx + C$$

$$y\ secx = x^2 secx + C$$

Given $y(0) = 1$

=>$y\ = 0^2 + C\ cos0$

=> $C\ = 1$

$$y\ = x^2 + cosx$$

$$y' = 2x - sinx$$

$$y'(\frac{\pi}{4}) = 2(\frac{\pi}{4}) - sin(\frac{\pi}{4}) = 2(\frac{\pi}{4}) - \frac{1}{\sqrt{2}}$$

$$y'(-\frac{\pi}{4}) = 2(-\frac{\pi}{4}) - sin(-\frac{\pi}{4}) = -2(\frac{\pi}{4}) + \frac{1}{\sqrt{2}}$$

Q. 26 If a curve passes through the point $(2, \frac{7}{2})$ and has slope $(1 - \frac{1}{x^2})$ at any point (x,y) on it , then the ordinate of the point on the curve whose abscissa is -2 is:

Option 1:

$-\frac{3}{2}$

Option 2:

$\frac{3}{2}$

Option 3:

$\frac{5}{2}$

Option 4:

$-\frac{5}{2}$

Correct Answer:

$-\frac{3}{2}$

Solution:

$$\text{Slope } = \frac{dy}{dx} = 1 - \frac{1}{x^2}$$

$$\Rightarrow \int dy = \int \left(1 - \frac{1}{x^2}\right) dx$$

$\Rightarrow y = x + \frac{1}{x} + \mathrm{C},$ which is the equation of the curve

since curve passes through the point $\left(2, \frac{7}{2}\right)$

$\therefore \frac{7}{2} = 2 + \frac{1}{2} + \mathrm{C} \Rightarrow \mathrm{C} = 1$

$\therefore y = x + \frac{1}{x} + 1$

when $x = -2$, then $y = -2 + \frac{1}{-2} + 1 = \frac{-3}{2}$

Q. 27 What is the value of integral $F(x) = \int \ln x \, dx$, if $F(1) = 5$?

Option 1:

$x \ln x - 5$

Option 2:

$x \ln x + 5$

Option 3:

$x \ln x$

Option 4:

$x \ln (x) - x + 6$

Correct Answer:

$x \ln (x) - x + 6$

Solution:

As we have learnt,

Constant of integration: -

$$\frac{\mathrm{d}}{\mathrm{d}x}\left(F\left(x\right) + C\right) = \frac{\mathrm{d}}{\mathrm{d}x}F\left(x\right) + 0 = f\left(x\right)$$

Hence $\int f\left(x\right) dx = F\left(x\right) + C$

- wherein

Where C is the constant of integration .

$$F(x)=\int \ln x dx=[x\ln x-x]+c$$

$$F(1)=[1\ln 1-1]+c=5\Rightarrow c=6$$

Q. 28 Number of points of non diffrentiability of $f(x)=\tan^{-1}x$ will be

Option 1:
0

Option 2:
1

Option 3:
2

Option 4:
infinite

Correct Answer:
0

Solution:
As we have learned

Properties of differentiable functions -

Trigonometric and inverse trigonometric functions are differentiable in their respective domain.

f(x)= $\tan^{-1}$ has domain R and there is no x where it will give vertical tangent so no. of points of non - diffrentiability of f(x) will be zero

Q. 29 The value of the integral $\int \left(x+\frac{1}{x}\right)^{n+5}\left(\frac{x^2-1}{x^2}\right)dx$ is equal to

Option 1:
$\frac{\left(x+\frac{1}{x}\right)^{n+6}}{n+6}+c$

Option 2:

$$\left(\frac{x^2+1}{x^2}\right)^{n+6}(n+6)+c$$

Option 3:

$$\left(\frac{x}{x^2+1}\right)^{n+6}(n+6)+c$$

Option 4:

none

Correct Answer:

$$\frac{\left(x+\frac{1}{x}\right)^{n+6}}{n+6}+c$$

Solution:

As we learnt

Type of Integration by perfect square -

Integration in the form of

(i) $\int f(x+\frac{1}{x})(1-\frac{1}{x^2})dx$

(ii) $\int f(x-\frac{1}{x})(1+\frac{1}{x^2})dx$

(iii) $\int f(x^2+\frac{1}{x^2})(x-\frac{1}{x^3})dx$

(iv) $\int f(x^2-\frac{1}{x^2})(x+\frac{1}{x^3})dx$

(v) $\int \frac{(1\pm\frac{1}{x^2})dx}{x^2+\frac{1}{x^2}}$

(vi) $\int \frac{f(x)dx}{ax^4+2bx^3+cx^2+2bx+a}$

- wherein

(i) $\rightarrow$ put $(x+\frac{1}{x})=t$

(ii) $\rightarrow$ put $(x-\frac{1}{x})=t$

(iii) $\rightarrow$ put $(x^2+\frac{1}{x^2})=t$

(iv) $\rightarrow$ put $(x^2-\frac{1}{x^2})=t$

(v) $\rightarrow$ for $1+\frac{1}{x^2}$ put $x-\frac{1}{x}=t$

$\rightarrow$ for $1-\frac{1}{x^2}$ put $x+\frac{1}{x}=t$

(vi) $\rightarrow$ put $(x+\frac{1}{x})=t$ if $b\neq 0$

put$(x^2+\frac{1}{x^2})=t$ if $b=0$

$$I=\int p^{n+5}dp \quad If\ x+\frac{1}{x}=p\ then,\left(1-\frac{1}{x^2}\right)dx=dp$$

$$\therefore\ I=\int\left(x+\frac{1}{x}\right)^{n+3}\left(\frac{x^2-1}{x^2}\right)dx=\int p^{n+5}dp=\frac{p^{n+6}}{n+6}+c=\frac{\left(x+\frac{1}{x}\right)^{n+6}}{n+6}+c$$

Q. 30 If f (x) is a quadratic expression such that $f(1)+f(2)=0$, and −1 is a root of $f(x)=0$, then the other root of $f(x)=0$ is :

Option 1:
$-\frac{5}{8}$

Option 2:
$-\frac{8}{5}$

Option 3:
$\frac{5}{8}$

Option 4:
$\frac{8}{5}$

Correct Answer:
$\frac{8}{5}$

Solution:
As we learnt

Roots of Quadratic Equation with real Coefficients -

α, β are roots if

$ax^2 + bx + c = 0$

is satisfied by $x = \alpha, \beta$

- wherein

$\alpha, \beta \in C$

$a, b, c \in R$

One root = $\beta = -1$, other = α

$f(x) = x^2 + (1 - \alpha)x - \alpha$

$f(1) = 2 - 2\alpha$

$f(2) = 6 - 3\alpha$

$f(1) + f(2) = 2 - 2\alpha + 6 - 3\alpha = 0$

$\Rightarrow \alpha = \frac{8}{5}$

Q. 31 If two vertices of an equilateral triangle, are $A(-a, 0)$ and $B(a, 0)$, $a > 0$, and the third vertex C lies above x-axis then the equation of the circumcircle of $\triangle ABC$ is

Option 1:
$3x^2 + 3y^2 - 2\sqrt{3}ay = 3a^2$

Option 2:
$3x^2 + 3y^2 - 2ay = 3a^2$

Option 3:
$x^2 + y^2 - 2ay = a^2$

Option 4:
$x^2 + y^2 - \sqrt{3}ay = a^2$

Correct Answer:
$3x^2 + 3y^2 - 2\sqrt{3}ay = 3a^2$

Solution:
We have given two vertices of an equilateral triangle, as $A(-a, 0)$ and $B(a, 0)$, $a > 0$

The midpoint of AB is (0, 0)

So, the third vertex of the triangle, C will lie on the y-axis. C= (0,k)

Coordinate of centroid, G of the triangle is

$$G = \left(\frac{a+(-a)+0}{3}, \frac{0+0+k}{3}\right) = \left(0, \frac{k}{3}\right)$$

We also know that circumcenter, centroid, and incenter of the equilateral triangle coincides.

$\text{Hence, the coordinates of circumcenter is } \left(0, \frac{k}{3}\right)$.

Since ABC is an equilateral triangle, So

$$\begin{aligned}
&\mathrm{AB} = \mathrm{AC} \\
&\Rightarrow (\mathrm{AB})^2 = (\mathrm{AC})^2 \\
&\Rightarrow \mathrm{k} = \sqrt{3}a
\end{aligned}$$

$\text{So, the coordinates of circumcenter is } \left(0, \frac{a}{\sqrt{3}}\right)$.

$$\text{Radius CG} = \frac{2a}{\sqrt{3}}$$

$$\begin{aligned}
&\text{Equation of circumcircle is} \\
&(x-0)^2 + \left(y - \frac{a}{\sqrt{3}}\right)^2 = \frac{4a^2}{3} \\
&\Rightarrow x^2 + y^2 - \frac{2a}{\sqrt{3}}y + \frac{a^2}{3} = \frac{4a^2}{3} \\
&\Rightarrow 3\left(x^2+y^2\right) - 2\sqrt{3}ay - 3a^2 = 0
\end{aligned}$$

Q. 32 If the line $\frac{x-3}{1} = \frac{y+2}{-1} = \frac{z+\lambda}{-2}$ lies in the plane,

2x−4y+3z=2,

then the shortest distance between this line and the line

$\frac{x-1}{12} = \frac{y}{9} = \frac{z}{4}$ is

Option 1:
2

Option 2:
1

Option 3:
0

Option 4:
3

Correct Answer:
0

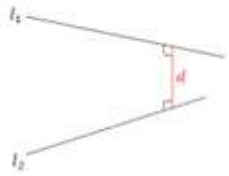
Solution:
As we have learned

Shortest distance between two skew lines (vector form) -

Shortest distance between $\vec{r}=\vec{a}+\lambda\vec{b}\ and\ \vec{r}=\vec{a_1}+\mu\vec{b}$ is given by

$$\left|\frac{\left(\vec{b}\times\vec{b_1}\right)\cdot\left(\vec{a}-\vec{a_1}\right)}{\left|\vec{b}\times\vec{b_1}\right|}\right|$$

- wherein



shortest distance is among the line which is perpendicular to both

$$LM=\vec{b}\times\vec{b_1}$$

shortest distance will be projection of PQ = $\vec{a}-\vec{a_1}$ on LM

$$(3,-2,-\lambda)\ lies\ on\ plane$$

$$6+8-3\lambda=2$$

So, $\Rightarrow 3\lambda=12$

$\lambda=4$

Where $\vec{b}\times\vec{c}=\begin{vmatrix}\hat{i}&\hat{j}&\hat{k}\\1&-1&-2\\12&9&4\end{vmatrix}=14\hat{i}-28\hat{j}+21\hat{k}$

So distance = 0

Q. 33 The base of an equilateral triangle is along the line given by $3x + 4y = 9$. If a vertex of the triangle is (1, 2), then the length of a side of the triangle is :

Option 1:
$\frac{2\sqrt{3}}{15}$

Option 2:
$\frac{4\sqrt{3}}{15}$

Option 3:
$\frac{4\sqrt{3}}{5}$

Option 4:
$\frac{2\sqrt{3}}{5}$

Correct Answer:
$\frac{4\sqrt{3}}{15}$

Solution:

$$AD = P = \frac{|3(1) + 4(2) - 9|}{\sqrt{3^2 + 4^2}} = \frac{2}{5}$$

Also $P = \frac{\sqrt{3}}{2}a = \frac{2}{5}$

Thus $a = \frac{4\sqrt{3}}{15}$

Q. 34 If a circle of radius R passes through the origin O and intersects the coordinate axes at A and B, then the locus of the foot of perpendicular from O on AB is :

Option 1:
$\left(x^2 + y^2\right)^2 = 4Rx^2y^2$

Option 2:
$\left(x^2 + y^2\right)^2 = 4R^2x^2y^2$

Option 3:

$\left(x^2+y^2\right)^3=4R^2x^2y^2$

Option 4:

$\left(x^2+y^2\right)(x+y)=R^2xy$

Correct Answer:

$\left(x^2+y^2\right)^3=4R^2x^2y^2$

Solution:

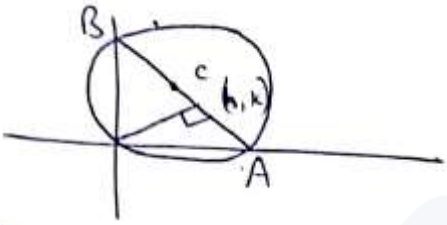
General form of a circle -

$$x^2+y^2+2gx+2fy+c=0$$

- wherein

centre = $(-g,-f)$

radius = $\sqrt{g^2+f^2-c}$



equation of line AB

$$y-k=\frac{h}{k}(x-h)$$

$$hx+ky=h^2+k^2$$

$$A\left(\frac{h^2+k^2}{k},0\right)$$

$$B\left(0,\frac{h^2+k^2}{k}\right)$$

$$0\,(0,0)$$

$$AB=2R$$

$$\frac{(h^2+k^2)^2}{k^2}+\frac{(h^2+k^2)^2}{h^2}=4R^2$$

$$\Rightarrow (h^2+k^2)\left(\frac{h^2+k^2}{h^2k^2}\right)=4R^2$$

$$(x^2+y^2)^3=4R^2x^2y^2$$

Q. 35 The integral $\int e^{\tan^{-1}x}\left(\frac{1+x+x^2}{1+x^2}\right)$dx is equal to

Option 1:
$$\frac{e^{\tan^{-1}x}}{1+x^2}+C$$

Option 2:
$$xe^{\tan^{-1}x}+C$$

Option 3:
$$\frac{xe^{\tan^{-1}x}}{1+x^2}+C$$

Option 4:
none of these

Correct Answer:
$$xe^{\tan^{-1}x}+C$$

Solution:
As we learnt

Result for integration by parts -

$$e^{f(x)}\left[g(x)f'(x)+g'(x)\right]dx = e^{f(x)}g(x)+c$$

Now, Putting $\tan^{-1}x = u$, we have $\dfrac{dx}{1+x^2} = du$

$$\int e^{tan^{-1}(x)}\left(\frac{1+x+x^2}{1+x^2}\right)dx = \int e^u(1+tan(u)+tan^2(u)))du$$

$$= \int e^u\left(sec^2u+tanu\right)du = tanue^u+C = xe^{\tan^{-1}x}+C$$

Q. 36 Which of the following metrice can be obtained by elementary transformation of $\begin{bmatrix}1 & 2\\ 3 & 4\end{bmatrix}$?

Option 1:
$\begin{bmatrix}1 & 3\\ 3 & 4\end{bmatrix}$

Option 2:
$\begin{bmatrix}1 & 2\\ 4 & 0\end{bmatrix}$

Option 3:
$\begin{bmatrix}2 & 3\\ 3 & 4\end{bmatrix}$

Option 4:
$\begin{bmatrix}2 & 1\\ 3 & 4\end{bmatrix}$

Correct Answer:
$\begin{bmatrix}2 & 3\\ 3 & 4\end{bmatrix}$

Solution:
As we have learnt,

Elementary row (column) transformation -

Adding to the elements of a row (column) , the corresponding elements of any other row (column) multiplied by any scalar k

- wherein

$R_i \to R_i + kR_j$
$C_i \to C_i + kC_j$

$$A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$$

$R_1 \to R_1 + R_2 \quad \begin{bmatrix} 4 & 6 \\ 3 & 4 \end{bmatrix}$

$R_1 \to \frac{R_1}{2} \quad \begin{bmatrix} 2 & 3 \\ 3 & 4 \end{bmatrix}$

Q. 37 **Statement 1 :** The slope of the tangent at any point P on a parabola , whose axis is the axis of x and vertex is at the origin , is inversely propotional to the ordinate of the point P.

Statement 2 : The system of parabolas $y^2 = 4ax$ satisfies a differential equation of degree 1 and order 1 .

Option 1:
Statement-1 is true; Statement-2 is true;
Statement-2 is a correct explanation for statement-1.

Option 2:
Statement-1 is true; Statement-2 is true;
Statement-2 is not a correct explanation for statement-1.

Option 3:
Statement 1 is true ; Statement 2 is false .

Option 4:
Statement 1 is false ; Statement 2 is true .

Correct Answer:
Statement-1 is true; Statement-2 is true;
Statement-2 is not a correct explanation for statement-1.

Solution:
Statement 1: $y^2 = \pm 4ax$

$$\Rightarrow \frac{dy}{dx} = \pm 2a \cdot \frac{1}{y} \Rightarrow \frac{dy}{dx} \propto \frac{1}{y}$$

Statement 2 :

$y^2 = 4ax \Rightarrow 2y\frac{dy}{dx} = 4a$

Thus both statements are true but a statement- 2 is not a correct explanation for statement-1.

Q. 38 Let $f(x) = e^{x^2}$ then f'(x) equals

Option 1:
$2xe^{x^2}$

Option 2:
e^{2x}

Option 3:
e^{x^2}

Option 4:
e^{x}

Correct Answer:
$2xe^{x^2}$

Solution:
As we have learned

Exponential functions -

$\frac{d}{dx}e^{f(x)} = e^{f(x)}.\frac{d}{dx}f(x)$

$\frac{d}{dx}e^{(x)} = e^{(x)}, \ \frac{d}{dx}a^x = a^x log_e a$

-

$f'(x) = df(x)/dx = d(e^{x^2})/dx = e^{x^2} * d(x^2)/dx = 2xe^{x^2}$

Q. 39 Solution of differential equation $\frac{xdy}{x^2+y^2} = \left(\frac{y}{x^2+y^2} - 1\right)dx$ is

Option 1:

$\tan^{-1}\left(\frac{x}{y}\right)+x=c$

Option 2:

$\tan^{-1}\left(\frac{y}{x}\right)+x=c$

Option 3:

$\tan^{-1}\left(\frac{y}{x}\right)+xy=c$

Option 4:

$\tan^{-1}\left(\frac{x}{y}\right)+xy=c$

Correct Answer:

$\tan^{-1}\left(\frac{y}{x}\right)+x=c$

Solution:

As we have learnt,

General form of Variable Separation -

$$d\left(\tan^{-1}\frac{y}{x}\right)=\frac{xdy-ydx}{x^2+y^2}$$

-

Given equation can be written as

$$\frac{xdy-ydx}{x^2+y^2}+dx=0$$
$$\Rightarrow d\left(\tan^{-1}\left(\frac{y}{x}\right)\right)+dx=0$$

On Integrating, we get

$$\tan^{-1}\left(\frac{y}{x}\right)+x=c$$

Q. 40 Find the value of $\tan^{-1}2+\tan^{-1}(-3)$

Option 1:

$\tan^{-1}(\frac{1}{5})$

Option 2:

$\pi + \tan^{-1}(\frac{1}{5})$

Option 3:

$\pi - \tan^{-1}(\frac{1}{5})$

Option 4:

$-\tan^{-1}(\frac{1}{5})$

Correct Answer:

$\tan^{-1}(\frac{1}{5})$

Solution:

$\tan^{-1}(2) + \tan^{-1}(-3)$

$= \tan^{-1}(2) - \tan^{-1}(3)$

$As\ x > 0, y > 0$

$= \tan^{-1}(\frac{2-3}{1-2\times 3})$

$= \tan^{-1}(\frac{1}{5})$

English

Q. 1 Rearrange the following paragraph to answer the following question

(A) Therefore, it is an encouraging symbol, but we must watch against our rising pace of populace expansion.

(B) Deficiency mitigation is one of the most momentous programmes.

(C) Even though this modification is sluggish and steady, it appears to be unswerving.

(D) The degree of success of this programme can be gauged when we examine the share of citizens underneath deficiency line

Which sentence should come FIRST in the paragraph?

Option 1:

A

Option 2:
B

Option 3:
C

Option 4:
D

Correct Answer:
B

Solution:
The correct arrangement of sentences is: BCAD

B- This is the opening line of the paragraph which establishes the idea of deficiency mitigation

C- C and B form a mandatory pair. Here 'this modification refers to deficiency mitigation.

A- This is the concluding sentence of the paragraph.

D-This sentence further elaborates about the triumph of this programme.

Q. 2 Find out the most appropriate word to replace the following set of words:

To make someone poor

Option 1:
Afflict

Option 2:
Anguish

Option 3:
Impoverish

Option 4:
Deride

Option 5:
Scuffle

Correct Answer:
Impoverish

Solution:
The process of making someone poor is called impoverishing.

Q. 3 Find the errors of pronoun.

The teacher was aware of their ability, therefore, she asked him to monitor the class during the break.

Option 1:
The teacher was aware of their ability

Option 2:
therefore, she asked him

Option 3:
No error

Option 4:
during the break

Option 5:
to monitor the class

Correct Answer:
The teacher was aware of their ability

Solution:
Since the rest of the sentence is about one person, the correct pronoun is 'his' instead of 'their'.

Q. 4 Find out the synonym for the given word:

Condemn

Option 1:
Excoriate

Option 2:
Elevate

Option 3:
Ameliorate

Option 4:
Mitigate

Option 5:
Assuage

Correct Answer:
Excoriate

Solution:
Excoriate and condemn are synonyms.

Q. 5 Find out the meaning of the phrasal verb

Break in

Option 1:
Enter like a thief

Option 2:
Ask one to do something

Option 3:
Interrupt

Option 4:
Trouble

Option 5:
Ask for a favour

Correct Answer:
Interrupt

Solution:
The verb means to interrupt

Q. 6 Find out the part which contains an error of subject-verb agreement:

A few metres beyond that village was seen two men along with a few bulls and Indian drivers

Option 1:
A few metres beyond

Option 2:
that village was seen two men

Option 3:
a few bulls and Indian drivers

Option 4:
No error

Option 5:
along with

Correct Answer:
that village was seen two men

Solution:
Men are two, hence, were to be used instead of was.

Q. 7 Read the paragraph and choose a suitable summary from the given options:

Discipline is the most important thing in everyone's life. Without discipline one cannot live a happy life. It is the act of living life following some rules and regulations. Discipline is everything which we do in the right way in right time. It leads us on the right path. We all follow various types of discipline in our daily lives. There are many examples like we wake up in the early morning, drink a glass of water, go to washroom to get fresh, do brush our teeth, take bath, take breakfast, go to school in uniform at right time, etc all are discipline.

Option 1:
Discipline and punctuality are the two important elements for worthy living.

Option 2:
It is discipline which changes lives. A disciplined person is sure to succeed.

Option 3:
Discipline is not only the most important trait but is also intrinsic.

Option 4:
Discipline is the only significant of all the principles

Option 5:
Discipline is the most indispensable principle to guide us

Correct Answer:
Discipline is not only the most important trait but is also intrinsic.

Solution:
"Discipline is not only the most important trait but is also intrinsic " carries the essence of the paragraph. It highlights both aspects; discipline is most important and intrinsic

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Q. 8 Change the voice:

Why does he abuse us?

Option 1:
Why are we abused?

Option 2:
Why he abuses us?

Option 3:
Why are we abused by him?

Option 4:
Why is he abusing us?

Option 5:
Why an abuse is done by him?

Correct Answer:
Why are we abused by him?

Solution:
"Why are we abused by him?" is the best choice. The subject changes into the object successfully.

Q. 9 Complete the following phrasal verb from the given choices:

We have been deprived ___ true happiness.

Option 1:
Off

Option 2:
Of

Option 3:
to

Option 4:
In

Option 5:
With

Correct Answer:
Of

Solution:
Deprive of is the idiomatically correct choice

Q. 10 Change the voice:

He wants me to kill him

Option 1:
He wants him to kill by me

Option 2:
He wants him to be killed by me

Option 3:
He wants me to have killed him

Option 4:
He wants me to have been killed him

Option 5:
He wants I to kill him

Correct Answer:
He wants him to be killed by me

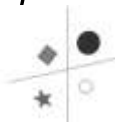
Solution:
The change from subject to object is the most apt in “He wants him to be killed by me”

Logical Reasoning

Q. 1 How the figure wiil look after 180 degree rotation

Option 1:

Option 2:



Option 3:

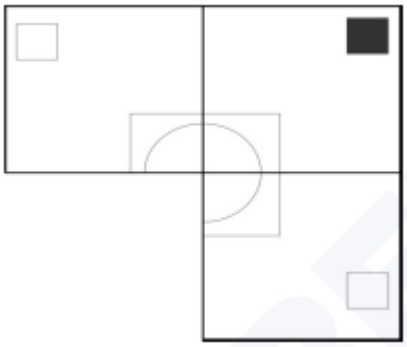
Option 4:

Correct Answer:

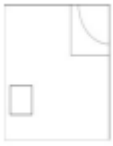
Solution:

it is clear from the figure

Q. 2

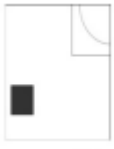


Option 1:



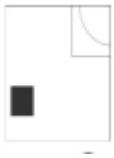
Option 2:

Option 3:



Option 4:

Correct Answer:



Solution:
The corresponding square is filled.

Q. 3 9 : 80 : : 100 : ?

Option 1:
901

Option 2:
1009

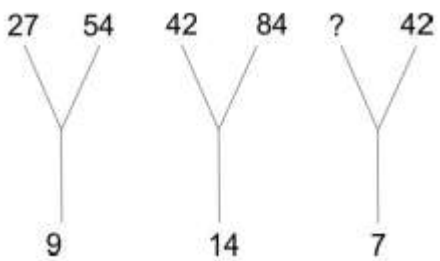
Option 3:
9889

Option 4:
9999

Correct Answer:
9999

Solution:
The relationship is $x : (x^2 - 1)$

Q. 4 Study the following table carefully to answer the questions that follows. Insert the Missing Character.



Option 1:
12

Option 2:
21

Option 3:
24

Option 4:
35

Correct Answer:
21

Solution:
we have (27+ 54)/ 9 = 9 ;

(42+ 84)/14 = 9

(x + 42)/ 7 = 9

x = 21

Q. 5 Find out which of the figure formed after combining the figures

Option 1:

Option 2:

Option 3:

Option 4:

Correct Answer:

Solution:
As except the correct option all other have more curves.

Q. 6 Choose the word which is least like the other words in the group

Option 1:
Calender

Option 2:
Year

Option 3:
Date

Option 4:
Month

Correct Answer:
Calender

Solution:
All Others are parts of a Calender

Q. 7 In each question below is given a passage followed by several inferences. you have to example each inference separately in the context of the passage and decide upon its degree of truth or falsity.

Now, In India the strength of girls in the colleges are
increasing because of the several movements led by the government and the other social institutions. There is another movement which is increasing i.e equal pay to female staff members. Only 30% of females are doing job and they are mostly belongs to cities, Now the government has been opening so many courses to skill the females belongs to the villages. There is a sharp increment in the ratio of new born girls which was very bad in India, but after the campaign "beti bachao beti padhao" led by our prime minister Narender Modi.

In India now the strength of girls in the colleges are decreasing continuously.

Option 1:
if the inference is "" probably true"" though not definitely true in the light of the facts given

Option 2:
if the inference is "" definitely true "" it directly follows from the facts given in the passage

Option 3:
if you think the data is inadequate , from the facts given you cannot say whether the inference is likely to be true or false

Option 4:
if you think the inference is'definitely false"" it contradicts the given facts

Correct Answer:
if you think the inference is'definitely false"" it contradicts the given facts

Solution:
The passage talks about the increasing strength of girls.

Q. 8 1,9,25,49,?,121

Option 1:
64

Option 2:
81

Option 3:
91

Option 4:
100

Correct Answer:
81

Solution:
The given series consists of squares of consecutive odd numbers.
$1^2, 3^2, 5^2 ....$
So, missing term =9^2=81

Q. 9 25 : 125 : : 36 : ?

Option 1:
180

Option 2:
206

Option 3:
216

Option 4:
318

Correct Answer:
216

Solution:
The relationship is $x^2 : x^3$

Q. 10 2,5,9,19,37,?

Option 1:
73

Option 2:
75

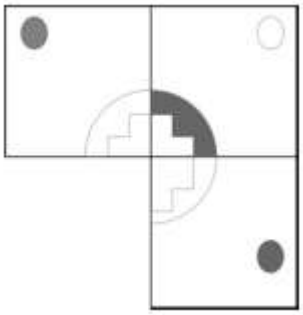
Option 3:
76

Option 4:
78

Correct Answer:
75

Solution:
Clearly we have: 2x2+1=5, 5x2-1=9, 9x2+1=19,
19x2-1=37
so, missing term= 37x2+1=75

Q. 11 (Insert the Missing Character)



Option 1:


Option 2:

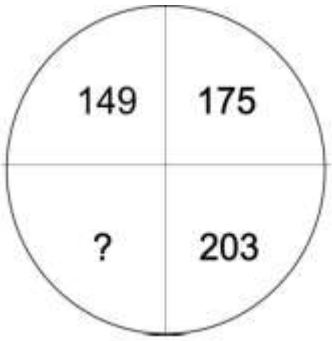

Option 3:


Option 4:


Correct Answer:


Solution:
The corresponding circle is blank

Q. 12 Study the following table carefully to answer the questions that follows. Insert the Missing Character



Option 1:
148

Option 2:
208

Option 3:
213

Option 4:
233

Correct Answer:
233

Solution:
we have 149 + 26 = 175 , 175+ 28 =203
203+30= 233

Q. 13 Earth is to Venus as Mercury is to

Option 1:
Sun

Option 2:
Pluto

Option 3:
Mars

Option 4:
Moon

Correct Answer:
Sun

Solution:
Venus is the planet nearest to the earth. Likewise ,Mercury is the planet nearest to the Sun.

Q. 14 Choose the word which is least like the other words in the group

Option 1:
8

Option 2:
28

Option 3:
64

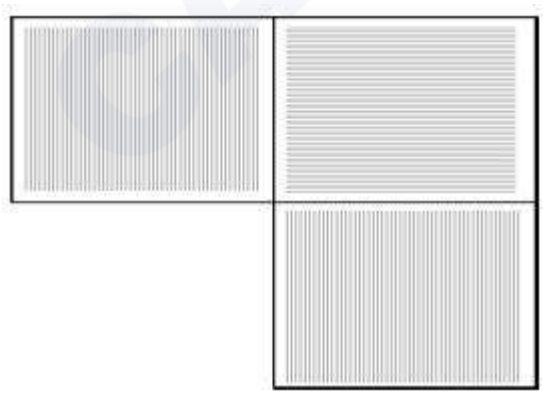
Option 4:
125

Correct Answer:
28

Solution:
Each of the numbers except 28, is a perfect cube.

Q. 15

Chart Logic (Insert the Missing Character)



Option 1:

Option 2:

Option 3:

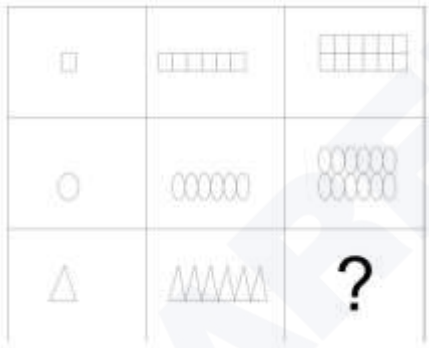
Option 4:

Correct Answer:

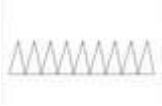
Solution:

The rotational angle is 90 degree.

Q. 16 Find the missing figure in the figure matrix

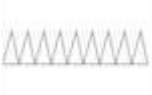


Option 1:



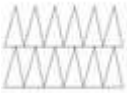
Option 2:

Option 3:



Option 4:

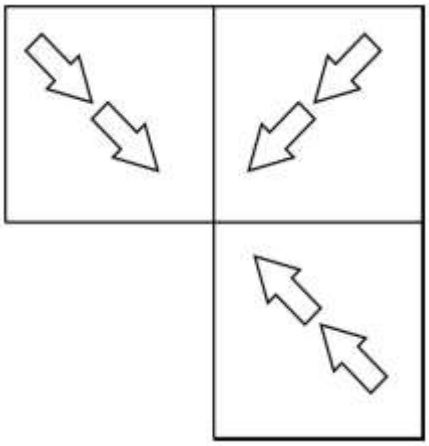
Correct Answer:



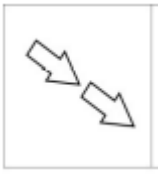
Solution:

the last figure have two rows and 6 items in each row.

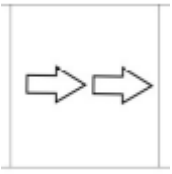
Q. 17



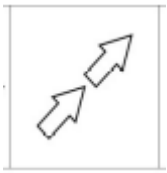
Option 1:



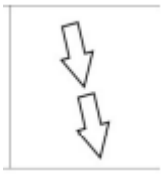
Option 2:



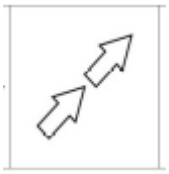
Option 3:



Option 4:

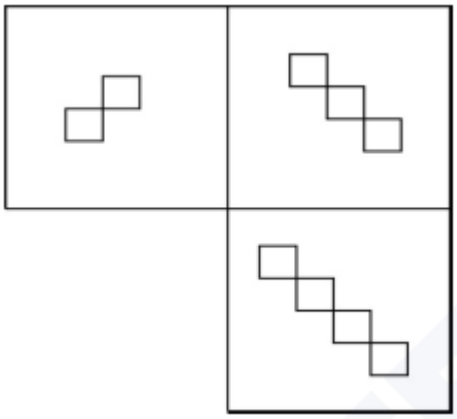


Correct Answer:

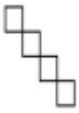


Solution:
The arrow heads pointed towards
the center

Q. 18

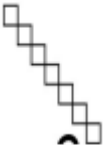


Option 1:

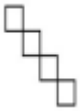


Option 2:

Option 3:



Option 4:



Correct Answer:

Solution:
The triangles are increasing by 1

Q. 19 Choose the word which is least like the other words in the group

Option 1:
Copper

Option 2:
Zinc

Option 3:
Brass

Option 4:
Aluminum

Correct Answer:
Brass

Solution:
Here, all except Brass, are metals, While Brass is an alloy

Q. 20 Coal : Mine

Option 1:
Power : Physics

Option 2:
Electricity : Light

Option 3:
Black : Night

Option 4:
Crude oil : Refinery

Correct Answer:
Crude oil : Refinery

Solution:
First is obtained from the second